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# ***JPRS Report***

# **Science & Technology**

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***USSR: Chemistry***

# Science & Technology

## USSR: Chemistry

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### Mathematical Model of Dispersion with Cavitation

18410063 Moscow *TEORETICHESKIYE OSNOVY KHIMICHESKOY TEKHOLOGII* in Russian Vol 21, No 5, Sep-Oct 87 (manuscript received 3 Dec 86) pp 709-710

[Article by N.S. Lamekin, Moscow Aviation Institute]

[Abstract] Existing theories on dispersal of liquids cannot be used to establish a rigorous relationship between droplet size and the hydrodynamic or geometric parameters of the spray jet, and therefore it becomes necessary to use experimental data. Previously derived equations correlating Reynolds and LaPlace numbers and the geometric characteristic (A) of a fuel injector with the ratio of mean droplet diameter to nozzle diameter can be used to give only an approximation of liquid droplet dispersal because they fail to account for cavitation. In the present work, a mathematical model is presented which includes hydrodynamic criteria, simplexes, and the geometric characteristics of the injector. Numerical values of constants in the model are selected by statistical means. Calculated and experimental values of median droplet diameter are said to agree well, with a root mean error of 5%. References 5 (Russian).

12765

UDC 66.074.512:66.069.83

### Effective Atomizer of Liquid with Suspensions

18410044 Moscow *KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE* in Russian No 9 Sep 87, pp 17-18

[Article by L.P. Baranov and L.I. Fen, engineers]

[Abstract] A description and discussion are presented of an effective acoustic atomizer of a liquid with suspensions which ensures that the diameter of droplets entering the gas flow does not exceed the maximum limit (300 microns), developed at the Zaporozhye Branch of the Scientific Research Institute for Organization of the Gas

Industry. The design ensures effective use of energy of the atomizing agent and simultaneous intensification of the processes of dispersing the liquid and the suspensions. The atomizer has passed industrial tests in ferrous alloy production during atomization of circulating water with a 150 mg/l concentration of suspensions. A systematic diagram of the atomizer is presented and described. Hydraulic characteristics of the atomizer, determined on a test stand under industrial conditions, are presented and discussed. Calculations of probability density functions of drops, according to diameters, showed that the atomizer can ensure fine atomization of a liquid. The median diameter of liquid drops is 130-160 microns; the working diameter of liquid drops does not exceed 300-350 microns. Figures 3; references: 7 Russian.

2791/9274

UDC 541.182.3:532.51

### Theory of Motion of Non-Spherical Aerosol Particles in Thermal Diffusion Fields

18410040 Minsk *K TEORII DVIZHENIYA NESFERICHESKIKH AEROZOLNYKH CHASTITS V TERMO-DIFFUZIONNYKH POLYAKH* in Russian 1983 (Paper No 1063-83 deposited at VINITI 3 Jan 83, signed to press 29 Oct 82) pp 1-14

[Article by M.N. Gaydukov, M.A. Melkumyan, and Yu.I. Yalamov, Minsk]

[Abstract] Development of a theory of motion of large aerosol, slightly deformed, spherical particles in thermal-diffusion fields is presented and discussed. Examination of motion of an aerosol particle in a constant temperature gradient field is described. The aerosol particle, under the action of a thermophoretic force caused by the temperature gradient begins to move with both translational and rotational motion. The motion is unsteady. It is concluded that the diffusion-phoretic rate of a bulging aerosol particle does not depend upon the share of its surface. References 16; 4 Russian; 12 Western.

2791/9274

**Organization of Chromatograph Signal Information Parameters for Input into "Elektronika DZ-28" Microcomputer**

18410064 Baku AZERBAJDZHANSKIY KHIMICHESKIY ZHURNAL in Russian No 6, Nov-Dec 86 pp 18-23

[Article by Yu.V. Trushkin, Ya. S. Abdullayev, R.A. Melikov, E.M. Mamedov, and R.M. Kasimov, Institute of Theoretical Problems in Chemical Engineering, AzSSR Academy of Sciences]

[Abstract] Chromatography is widely used for qualitative and quantitative analysis of products, and the automation of these analyses through computerization has become one of the basic stages in improving the effectiveness of scientific research in this area. This problem is currently being met with the "Elektronika DZ-28" microcomputer in conjunction with suitable specialized peripheral devices linked to the control unit. Thus, in a typical widely-used method of inputting and processing measured information with preliminary analog-to-digital signal conversion and periodic input to a computer, the chromatograph is physically linked to the microcomputer in a chromatograph-digital voltmeter-control unit-computer setup. However, a high frequency of referral to the output signal of the chromatograph over a sufficiently long time interval of analysis results in excessive input of measured information into the computer. The latter causes programming problems in solving complex algorithms for selecting chromatographic peaks and computing the areas of partially overlapping peaks, as well as in cases where the device is also used to interface the computer with other sources of information. Preliminary compression of signals thus becomes desirable with the separation and input to the computer of those information parameters of the signal which could be used in carrying out subsequent computations related to qualitative and quantitative analysis. In chromatographic analysis, these information parameters consist of areas and times of chromatographic peaks within the time interval of analysis. With good resolution of chromatographic peaks, formation of these information parameters of the chromatographic signal can be carried out with a serially produced type I-02 integrator. In the

present work, this integrator was interfaced with an "Elektronika DZ-28" computer to provide conversion and transmission synchronization of information parameters of recorded chromatographic peak areas and times. Figures 2; references 3 (Russian).

12765

**Chromatographic and Mass Spectrometric Detection of Dexamethasone and its Metabolites in Human Biological Fluids**

18410082 Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 42, No 9, Sep 87 (manuscript received 16 May 86) pp 1678-1683

[Article by G.M. Rodchenko, V.P. Uralets, and V.A. Semenov, All-Union Scientific Research Institute of Physical Culture, Moscow]

[Abstract] The unwarranted and uncontrolled use of drugs like dexamethasone in athletic competition or intense training is particularly dangerous. For this reason, the Medical Commission of the International Olympic Commission included corticosteroids in its list of forbidden substances in April 1986. To enforce this rule, one needs a sensitive and reliable method for measuring these drugs in biological fluids. Capillary GC-MS is most suitable in this regard. A method for measuring dexamethasone as the trimethylsilyl methoxyimine was developed, using beta-glucuronidase to deconjugate the steroids, methoxyamine hydrochloride to methoxylate, and trimethylsilyl imidazole to siliate. Derivatives were chromatographed on a fused quartz column with a cross-linked methylsilicone stationary phase. The column was directly interfaced to a quadrupole mass spectrometer, using electron impact ionization. Dexamethasone and its 6-hydroxymetabolites were well resolved from natural corticosteroids. The results indicate that dexamethasone is excreted from man mainly as metabolites, principally the 6-hydroxy derivative. Dexamethasone can be reliably measured in urine for 30 hours after injection in tablet form. Figures 3; references 15; 4 Russian, 11 Western.

12126

UDC 577.152.193/133/134

**Catalytic Activity of Hemin in Aqueous-Micellar Solutions**

18410100 Moscow VESTNIK MOSKOVSKOGO  
UNIVERSITETA: SERIYA 2: KHIMIYA in Russian  
Vol 28, No 5 Sep-Oct 87 (manuscript received 19 Feb  
86) pp 491-497

[Article by Ye.V. Vorobyeva and N.N. Ugarova, Department of Chemical Enzymology]

[Abstract] Metalloporphyrins such as hemin are used widely in catalytic systems which model heme-containing enzymes. Monomerization of hemin under the influence of surfactants (SA) was studied along with kinetics of  $H_2O_2$  breakdown in such systems. In a previous paper,

it was shown that hemin forms complexes with SA and that, at high concentrations of TX-100, an equilibrium exists in micelles between the dimer and monomer of hemin. Analogous results were obtained for hemin in the presence of SDS. The constant obtained for hemin in micelles was lower than the constant in water; evidently, the aqueous-micelle medium prevented collision of hemin monomers in the cellular liquid. It was shown that only the monomer form of hemin was catalytically active in  $H_2O_2$  breakdown. An important role was established for the protein globule in this catalysis: this protein effectively protects hemin from oxidative destruction, maintaining it in the monomer state. Figures 3; references 19: 5 Russian (1 by Western author), 14 Western.

7813/9274



### Role of Chemistry in National Economic Development

18410118 Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA KHIMICHNYKH NAVUK in Russian No 5, Sep-Oct 87 pp 3-5

[Article by V.S. Komarov: "The Role and Tasks of Chemistry in the Development of the National Economy"]

[Text] The idea, put forward by the April Plenum of the CPSU Central Committee and approved by the 27th Party Congress, of accelerating the country's social-economic development and achieving, on the basis of this, a qualitatively new state of the socialist society, which has begun the active process of thorough restructuring, is truly revolutionary in nature. Successful fulfillment of the tasks set by the party will in many ways depend on accelerating the development of the base sectors, which are the initiators of scientific-technical progress.

The chemical industry is an extremely important unit of the national economy. It is impossible to ensure a high level of development for the national economy, a solution to the problems of the Party's agrarian program, and an increase in the technical level of all national production without widescale use of chemical technology and chemical output. At present, the level of development of chemistry and use of its materials in various sectors of industry serves as a distinctive feature of society's technical potentials. The roots of the chemical industry penetrate the entire national economy, and its level determines the progress of the country's productive forces.

This imposes a particular responsibility on chemistry and the chemists-scientists who must bring about an abrupt turn toward the needs of the national economy, bring theory and practice together, and raise the yield from academic and sectorial institutes. At the same time, the rates of scientific research, accumulation of new scientific knowledge, and formulation of advanced technology, ensuring a radical increase in labor productivity and product quality, should be developed more rapidly than those of production. Science should work for tomorrow and see the future and developmental trend of national production. Today this is the main problem, which we should take into consideration in our work, in improving and intensifying scientific research and in restructuring our world view, attitude toward work, and evaluation of the quality of the results obtained. The habits, work-attitudes and indifference toward the fate of the results obtained, which have been forming for years, require a sharp re-evaluation of these negative aspects and activation of the vitally important position of each one.

Today we should think about the subject matter of the research carried out, about its topicality and expediency. Here, the main goal of scientific developments should be

to ensure for domestic chemistry world-leading positions in basic and technological research. Scientists must focus particular attention on the basic directions of science, on those of them that ensure an advance in theory, techniques, and technology, and lead domestic chemical science and industry to the most advanced milestones.

The chemists of Belorussia are faced with great tasks. Work must be done in the sphere of developing scientific bases and the technology of the electromagnetic method of desludging potassium ores and separating them electrostatically. This will make it possible, with a 20-25% energy savings, to obtain a 95%-concentrate and, the main thing, to rid potassium production of wastes—the sources of environmental pollution.

Great attention should be paid to creating the technology to produce chlorine-free potassium fertilizers, which are extremely necessary to agriculture for crops such as potatoes, peas, flax, perennial grasses, etc. Work on the development of physicochemical bases and the technology to obtain slow-soluble fertilizers with improved agrochemical properties will be considerably expanded and intensified. All this will lead to decreasing the consumption of fertilizers, lessening their erodibility, and reducing the adverse effect on the environment, particularly on reservoirs.

Studies are being made on adsorbents and catalysts to develop scientific bases and methods of synthesizing new adsorbents and catalysts, with the porous structure and chemical nature of the surface being assigned in advance. The fact that at present 80-85% of chemical industrial processes are carried out with the aid of catalysts attests to the importance of this work.

Development of catalysts is a key problem in realizing the basic paths of technical progress in the chemical industry which ensure the transition from extensive to intensive forms of production. The development and use of more active catalysts opens up the possibility of increasing the productivity of units without renovating them. The work will be directed toward obtaining active catalysts for low-temperature synthesis of ammonia, complete combustion of exhaust gases, isomerization, obtaining motor fuels and many chemical intermediate products from a mixture of carbon monoxide and hydrogen, etc. This work is partially done at the chemistry institutes of the BSSR Academy of Sciences and will be considerably expanded.

In addition to this, research is planned in the development of catalysts and methods for deep petroleum refining, particularly to obtain motor fuel from heavy petroleum fractions such as vacuum gas oil and mazut.

In the sphere of adsorbents, there are plans for intensified development of basic experimental and theoretical studies on the synthesis of highly efficient, non-traditional mineral adsorbents with a slightly adjusted structure and a surface that is chemical in nature. Particular attention will be paid to obtaining porous fibrous carbon

and metal-carbon adsorbents for both medical and industrial use, as well as block metal-ceramic porous materials—adsorbents and carriers for catalysts possessing certain advantages over ordinary porous materials for an analogous purpose.

The program, worked out for the period 1986-2000, for step-by-step organization of the subject matter of the institutes of the Department of Chemical and Geological Sciences of the BSSR Academy of Sciences on solving the most important problems of chemicalization of the national economy, specifies the creation of scientific bases for the synthesis of new inorganic compounds with specific properties, including ecologically safe substances for the needs of household chemistry. Scientific bases will be developed to create new passivating and other glass-like coatings for high-powered semiconductor instruments and surface-distributed electric motors and for devices operating in the ultra-high-frequency area.

Comprehensive research has been outlined on a number of oxide, particularly glass-like, systems to determine the conditions for coating formation, the mechanism of their corrosion, electric conductivity, and other parameters which may lead to reducing their brittleness. The search for methods of synthesizing valuable low-tonnage chemicals and materials for the chemical, electronics, radio engineering, medical, and microbiological industries and other sectors of the national economy will be expanded.

On the subject, "The Study of the Structural Organization, Molecular and Cellular Bases of the Functioning of the Most Important Proteins, Peptides and their Complexes," particular attention will be paid to studies on creating a model of phospholipid regulation of enzyme activity in the biological membrane, extremely necessary for purposeful action on organs and tissues in pathology.

The results obtained are basic for the development of diagnostic methods and inclusion of medications and enzyme systems in damaged organs, as well as for the creation of highly sensitive and specific model systems to control the physiological action of medicinal compounds and environmental pollution.

In organic chemistry and the chemistry of elemental organic compounds, research will be directed toward further, more intensified development of the scientific bases of synthesizing nitrogen-containing compounds with a broad spectrum of properties and spheres of use. There will be development of the chemistry of organic compounds of transition metals, used as catalysts in homogeneous catalysis, as well as synthesis of salts of peroxides and polychloroorganic compounds, which are, respectively, the initiators of polymerization and agents for plant protection.

In the field of high molecular weight compounds, intensified development of the physicochemical bases and technology of obtaining new micro- and ultrafiltration membranes and membrane processing procedures for various technological media and sewage waters will be

continued. Great attention will be paid to studying methods of obtaining and synthesizing polymers with the properties necessary to produce electronic engineering items and, on their basis, ionites and ion-exchange fibers, textile-auxiliary materials, coagulants, photo-sensitive materials, glues, varnishes, photoresistive materials, anti-static materials, etc.

The physicochemical bases and methods of dehydrating sapropels and the technology for their extraction, drying, and use in agricultural production will be developed in accordance with the directive, "Development of the Theory of the Formation and Transformation of Biogenic Deposits and Creation of the Scientific Bases for New Resource-Saving Technology and Equipment for Comprehensive Utilization of Peat, Sapropels, Brown Coals, and Bituminous Shales." This will give agriculture an inexhaustible source of quickly reducible organic fertilizer, the stores of which in the republic are over 3 billion tons.

In the current Five-Year Plan, research will be completed and recommendations given for efficient use of nature on improved drainage basins, taking into consideration the needs of all sectors of the national economy, as well as the social and economic aspects and requirements of nature conservation. There will be further development of work connected with the study and efficient use of the bituminous shales and brown coal of Belorussia as solid fuels, as well as of the technology and ways to use the mineral part of solid fuels and wastes in the sectors of the national economy.

The tasks of accelerating scientific-technical progress impose new, heightened demands on chemistry personnel and the style and methods of their work. The complex and broad-scale tasks posed by the Party require the creative initiative and persistent work of every scientific colleague, a sober evaluation of work results, and rapid delivery of advanced developments for industrial utilization.

12151

#### **Baromembrane Processes in Production of High Purity Chemicals**

18410066a Moscow *KHIMICHESKAYA PROMYSHLENNOST* in Russian No 8, Aug 87 pp 471-475

[Article by A.A. Yasminov and A.A. Yefremov]

[Abstract] The current stage in technological progress may be characterized as a vigorous development in microelectronics, electronics, and precision machine building. This tends to stimulate improvements in existing methods and development of new ones for obtaining very pure chemical substances which are used as a base for producing a number of important components and materials in modern technology. They are used as solvents, cleaning agents, pickling components, materials for preparing single crystals, integrated microcircuits,

etc. The quality of high purity substances is determined by the amount of trace impurities present. Essentially, all theoretical and practical problems related to the preparation, properties, storage, and utilization of high purity products come down to the problem of obtaining high purity liquids, and preference is given to methods which limit the input of additional contamination. Processes such as crystallization, distillation, absorption, fractionation, and ion exchange are used to obtain substances with as little as  $10^{-6}$  or  $10^{-7}\%$  by weight of individual impurities. The presence of ionic impurities in liquids exceeding this amount lowers the quality of microelectronic components. For example, the presence of Au, Cr, Cu, and Fe at the silicon dioxide/silicon interface in a semiconductor device in an amount greater than  $10^{-3}\%$  or traces of organic matter increases the exit threshold potential and causes local overheating and incomplete adhesion of the photosensitive layers. Insoluble particles of micron and sub-micron size may also be present in solvents and pickling solutions used in fabricating microcircuits, causing defects. It is therefore necessary to conduct supplemental purification operations prior to the final stage, the most preferred being baromembrane processes, using polymer semi-permeable membranes. These processes, which include reverse osmosis, ultrafiltration, and microfiltration, are characterized by low energy output, simple equipment, and are unique in that no further chemical or thermal treatment is needed. The latter is very important in preserving the properties of the substance. In the present work, the possibilities and some of the problems encountered in using baromembrane processes for obtaining high purity substances are reviewed. Figures 4; tables 3; references 14: 12 Russian, 2 Western.

12765

#### Fluidized Bed Structure Models

18410066b Moscow *KHIMICHESKAYA  
PROMYSHLENNOST* in Russian No 8, Aug 87 pp  
496-502

[Article by O.M. Todes]

[Abstract] Despite thousands of publications in scientific journals, a single universally accepted theory on the structure of the fluidized state is still lacking, and equipment design problems are solved by using models. A review of various proposed models indicates that in constructing these models, researchers departed from some particular external circumstances of special interest to the theoretician, such as heat exchange, catalytic reactions, drying, etc. Thus, a "bubble" model, developed to explain the drop in yield in catalytic reactions taking place in a fluidized bed, proved inadequate to give a quantitative explanation of the catalytic reaction. The physicist visualizes the fluidized state as the chaotic movement of solid particles analogous to that of the thermal movement of molecules in a gas or liquid,

although attempts at a direct transition to molecular-kinetic theory and statistical physics such as the Boltzmann or Fokker-Planck equations, failed to give satisfactory results. Other models reviewed include the "two liquid" model and the gravitation-vibrating model. Computerization of some of these models also failed. Figures 5; references 25: 14 Russian, 11 Western.

12765

#### Seminar of European UN Economic Commission "Role of Chemical Industry in Food Production"

18410043 Moscow *KHIMICHESKAYA  
PROMYSHLENNOST* in Russian No 9, Sep 87 pp  
571-573

[Article by V.S. Yevsyukov and V.A. Gavrilenko]

[Abstract] Participants of the seminar, held in Moscow 18-22 May 1987, included 105 representatives from 16 European countries, the USA, and four international organizations. The seminar was planned to examine all areas in which chemistry helps to solve food problems and use of these findings to intensify and accelerate the increase of food reserves and to improve the quality of food products by using chemistry. Yu.A. Besspalov, Minister of the USSR Chemical Industry, read a paper on the "Role of the Chemical Industry in Realization of the USSR Food Program," in which he described successes of the USSR Chemical Industry in production of mineral fertilizers, chemical means of protecting crops and farm animals from pests and diseases, and polymer materials used for agroindustrial needs of the country. "Contributions of the Organic Synthesis Industry to Food Production," presented by V.M. Belikov, Institute of Elemental Organic Compounds, USSR Academy of Sciences, described current achievements of chemical sciences in producing food from traditionally unused or discarded farm raw material, chemical synthesis of vitamins, and enzyme and chemical synthesis of amino acids to be used as a protein component in food. Other papers presented by Soviet authors included: "New Anti-Stress Preparations with Cytokinin-Like Activity" by Yu.A. Barkakov; "Complexones in Solving Problems of the USSR Food Program" by N.M. Dyatlova, et al., and "Using Chemistry to Solve Problems of Using Biological Substances of the World Ocean for Food" by Ye.S. Vayerman and S.V. Rogozhin.

2791/9274

UDC 658.5.012.12:66.013

#### Advance Plans for Developing Technical-Economic Indicators of Chemical Machine Building

18410102b Moscow *KHIMICHESKOYE I  
NEFTYANOYE MASHINOSTROYENIYE* in Russian  
No 10, Oct 87 pp 39-41

[Article by V.A. Morozov, engineer]

[Abstract] When considering long-range plans for modernizing production, one should address not only present needs, but also further improvements and developments.

Current methods of prognosticating industrial growth are often based on architectural considerations without reference to potential growth, possible shifts in emphasis, and various interactions with other units. A method for predicting growth and development of various undertakings was discussed, which is capable of prognostic modeling and development of parametric characteristics, enabling determination of the relationship to other undertakings and adequate energy, territorial, and other resources. When used in planning exercises of projecting investment measures, this method would lend itself to calculation of proper reserves, which could intensify the use of production potential. References: 6 Russian.

7813/9274

621.865.8.003.13.001.24

### Calculating Economic Effectiveness of Introducing Robots

18410102a Moscow *KHIMICHESKAYA  
PROMYSHLENNOST* in Russian No 10, Oct 87 pp  
628-629

[Article by V.I. Shulyak and V.S. Zazulya]

[Abstract] One of the principal means of technical progress is introducing robots into production processes. The problem with them is in evaluating their cost

effectiveness. A simple substitution of the earning potential of the replaced personnel is not appropriate and normally leads to the conclusion that robots do not "pay for themselves." To some extent, sociological aspects shift the imbalance, justifying the use of robots in excessively dangerous working situations. Economically, it is difficult to show the advantages of using robots. A new approach to this problem is proposed, based on calculating the economic effectiveness through national income:

$$E = Ch (N_D + Z_{p1}) - (K_E K_R + Z_R + Z_A)$$

where Ch — number of replaced workers;  $N_D$  — national income per individual worker;  $Z_{p1}$  — annual income of the worker;  $K_E$  — effectiveness coefficient of capital investment;  $K_R$  — total capital investment;  $Z_R$  — operational cost, and  $Z_A$  — amortization of equipment.

On the basis of this formula, robot introduction may be effective from the State's point of view but not necessarily from that of the plant management.

7813/9274



**Quantitative Description of Chain Detonation,  
Using Linear Approximation Theory of  
Branched-Chain Processes**

18410084 Moscow IZVESTIYA AKADEMII NAUK  
SSSR SERIYA KHIMICHESKAYA in Russian No 6  
Sep 87 (manuscript received 19 Sep 86) pp 2102-2106

[Article by Ye.N. Aleksandrov, V.S. Arumynov, I.V. Dubrovina, and S.N. Kozlov, Institute of Chemical Physics, USSR Academy of Sciences, Moscow]

[Abstract] The goal of this work was to achieve complete agreement between theory and experiment for the combustion of a hydrogen-oxygen mixture near the first limit in a boric acid-washed quartz reactor. Anomalous deep burn-out was previously reported in such a system. In order to assure constant heterogenous destruction of atoms, independent of hydrogen atom concentration, small, liquid nitrogen-cooled quartz devices were used in the reactor inlets. An expression was derived for the rate of pressure change in terms of concentration, rate constant for branching, initial pressure, and first limit pressure. At initial pressures between 1.03 and 1.3 times the limit pressure, negative chain interactions in the gas phase and chain formation may be neglected. Experimental data obtained at 0.075 torr for final burnout and the maximum reaction rate agreed well with calculated values. At 0.079 and 0.082 torr, the maximum rate exceeded calculated values by 10-15%, which does not exceed experimental error and may be connected with microimpurities present in the reactants. Final burnout was the same in kinetic and diffusion regions, while the maximal rate differed by a factor of two. The anomalous deep burnout observed demonstrates the connection between the flame in the heated region of the reactor and the lubricant on the cooled reactor surfaces. One may conclude that for the first time, agreement between calculations and experiment has been achieved for the final burnout and maximum reaction rate of the chain detonation of a fulminating powder near the first combustion limit. Figures 1; references 15; 12 Russian, 3 Western

12126

**Combustion in Supersonic Fluxes**

18410119a Novosibirsk FIZIKA GORENIYA I  
VZRYVA in Russian No 5, Sep-Oct 87 pp 5-15

[Article by V.K. Bayev, V.I. Golovichev, and P.K. Tret'yakov, Novosibirsk]

[Abstract] Interest in combustion in supersonic fluxes developed with the concept of the ramjet engine, which allowed aircraft to travel at supersonic speeds. Various combustion schemes were devised to control the thrust vector and to control flight patterns. Consequently, mathematical arguments are being developed for the combustion chamber, as well as the inlet, diffuser, and nozzle, to facilitate controlled combustion. The latter receives primary attention on the basis of physical and

mathematical models which provide indications of oxygen requirements, stoichiometric coefficients for efficient combustion, thrust enhancement, and temperature and pressure relationships for efficient engines. The models cover realistic thermodynamic and thermochemical parameters in engines of different configurations. New advances in computer simulation are expected to further improve the ramjet engine and its potential applications. Numerical modulation of the complex processes occurring in supersonic flow combustion has shown this to be a valuable approach in deriving new information. The models and information derived in this manner have also found application in chemical and gas-chemical lasers. Figures 14; references 36; 29 Russian, 7 Western

12172/9274

**Effects of Irradiation on Nonstationary  
Combustion of Condensed Media**

18410119b Novosibirsk FIZIKA GORENIYA I  
VZRYVA in Russian No 5, Sep-Oct 87 pp 16-26

[Article by V.Ye. Zarko, V.N. Simonenko, and A.B. Kiskin, Novosibirsk]

[Abstract] Experimental and mathematical data were obtained on the effects of radiation on nonstationary combustion of condensed media, using H + 1% C, H + 1% PbO, and ammonium perchlorate composition fuels. Radiation was provided by 10 kW xenon lamps and CO<sub>2</sub> (1.06 micrometer, 40 W) and YAG-Nd (1.06, 70 W) lasers. The combustion rate in assessing the radiation effects was calculated from the following fundamental relationship:  $T^* = T^*_0 - T_0 = q/\mu(q)$ , where  $q$  represents absorbed radiation flux,  $T^*_0$  the effective initial temperature, and  $\mu_0(T_0, q) = \mu_0(T^*_0)$ . The correction factor section was introduced into the right side of the equation to account for absorption and deflection of radiation from the flame surface. For the fuels H + 1% C and H + 1% PbO, the values of the section were, respectively, 0.5 and 0.6. Analysis of the combustion rates of the different solid fuels and the amplitude-frequency characteristics of the combustion rates in response to radiation demonstrated that maximum rate peaks corresponded to "resonance" frequencies. These observations indicated that combustion rates may be regulated by radiation, by varying the amount of absorption ( $\mu$ ) in the fuel, and the energy characteristics of the radiation. Further understanding of radiation effects on the course of combustion will have to await improved research methods and expansion of the wavelength bands employed in such studies, particularly in the ultraviolet region. In addition, the intensity of radiation fluxes should be increased to  $10^3$  W/cm<sup>2</sup>, and frequency band recording needs to be expanded to at least 1 kHz. Finally, systematic studies need to be done on the stability of combustion, fluctuations, and critical conditions leading to quenching. Figures 4; references 19; 10 Russian, 9 Western

12172/9274



**Lightning in Insulators — Practical Applications for Plasma-Chemistry**

18410085b Moscow KHIMIYA I ZHIZN in Russian No 10, Oct 87 pp 27-31

[Article by L.A. Ashkinazi, candidate of Physical-Mathematical Sciences]

[Abstract] Strong electrical fields cause flash-over, decomposition, aging, heating, and other forms of insulator failure. The resultant heat can quickly liquify or vaporize a solid. Since the center of the insulator heats most strongly, channels form, and pressure increases in them, causing ruptures. In ceramic oxide or halide salt insulators, the holes which form appear metallized, while in hydrocarbon material, they are covered with graphite. It is possible that fusion or vaporization precedes flash-over. In liquid insulators after several flash-overs, resistance begins to decrease. Flash-overs in transformer oil cause cracking, polymerization, and formation of free radicals, hydrogen, methane, ethane, ethylene, acetylene, propane, propylene, ammonia, amines, water, hydrogen peroxide, alcohols, aldehydes, and acids. Decomposition involves emulsion gas bubbles which are always found in

the oil. Flash-over in gas bubbles and in the gas layer between the insulator and the electrode causes aging in solid materials. The reactions which occur when a current flows in a plasma can be used to elucidate the chemistry of a flash-over. In plasma-chemical etching, which has been very useful in the microelectronics industry, processes involving ionization and radical formation occur. Heating the gas to several thousand degrees presents fewer problems than the rapid cooling required. Nitrogen oxides and ozone can be obtained in an air-argon plasma and acetylene in a hydrogen-methane plasma. Since plasma-forming gases can react with noncontiguous substances, trichlorosilanes can be formed from silicon tetrachloride, and formaldehyde from methane. Plasma-chemical processes are amenable to scale-up; 200,000 tons of acetylene are produced annually by this process. Nitrogen oxidation, using plasma, is also promising, as are applications in metallurgy and the chemical industry. Examples include producing metals from metal halides and sulfur from hydrogen sulfide and synthesizing organic and polymer compounds. Figures 1.

12126

### Pilot Plant Testing of Preparation of Trace Element-Enriched Superphosphate

18410070 Baku AZERBAJDZHANSKIY  
KHIMICHESKIY ZHURNAL in Russian No 6,  
Nov-Dec 86 pp 117-120

[Article by M.S. Alosmanov, S.M. Ibragimova, A.P. Dzhaferov, R.A. Sardarly, and A.K. Rzayeva, Azerbaijan Institute of Petroleum and Chemistry imeni M. Azizbekov]

[Abstract] One of the most promising methods for increasing the effectiveness of mineral fertilizers is through the addition of trace elements. Production of mineral fertilizers containing trace elements is held back due to the lack of raw materials containing the trace elements, although various industrial wastes containing them do exist. Therefore, studies were made of the technology for preparing a superphosphate enriched with trace elements, using ore wash waters from the Kedebekskiy copper deposit in the Azerbaijan SSR. To check the results of laboratory findings, tests were conducted on the fifth production line of a superphosphate chamber at the Sumgaitskiy Superphosphate Plant. Tests were conducted by adding trace element-containing ore waters at various stages of superphosphate production such as the apatite-sulfuric acid mixing stage and the pelletization stage, making it possible to obtain data characterizing the process under large scale conditions. A flow diagram is presented which shows the production of superphosphate with ancillary tanks and lines. Basic conditions for the tests were maintained at normal superphosphate production levels. Apatite ore output was set at 30 t/hr, sulfuric acid 30.5-30.9 t/hr, and ore wash water containing trace elements 3.0-4.8 t/hr; the temperature of the sulfuric acid entering the mixer was 60-67° C, and 107-112 and 113-116° C, respectively, in the mixer and the superphosphate chamber. Gases were evacuated from the system with ventilators of 24,000 m<sup>3</sup>/hr capacity. The tests confirmed laboratory results and yielded additional data characterizing the process under large scale conditions. Figure 1; tables 2; reference 1 (Russian).

12765

UDC 632.95:633.71

### Plant Growth Regulators in Protecting Tobacco From Fall Frosts

18410120a Moscow AGROKHIMIYA in Russian No 10,  
Oct 87 (manuscript received 25 Dec 86) pp 83-86

[Article by I.P. Grinberg and R.A. Osipova, Moldavian Tobacco Scientific Research Institute, "Doyna" Scientific Production Association, Kishinev]

[Abstract] A three-year study was conducted to assess the effects of spraying tobacco fields with plant growth regulators in protecting the plants from the adverse effects of autumn frosts. The study was conducted at the

"Gratiyeshti" farm of the "Doyna" Scientific Production Association and involved spraying the tobacco fields a few days prior to harvesting either with 40 mg/plant (1.7-2.2 kg/ha) of ethephon (Ethrel) or hydrel. Both agents acted in a similar manner, accelerating maturation by 15-17 days and facilitating earlier harvesting, thus affording protection from the adverse effects of unexpected frosts. The net effect was an annual increase in the yield of 1.1-1.3 quintals/ha. In addition, a side benefit observed consisted of improved chemical balance of the tobacco leaves. Thus, with ethephon, the carbohydrate concentration increased by 35.7%, and the protein content fell by 21.8%, yielding a carbohydrate:protein ratio of 1.62 with 40 mg/plant of ethephon. The corresponding chemical changes with hydrel were an increase in the carbohydrates by 52.9% and a decrease in the protein content by 23.9%, giving a ratio of 1.68 (vs. 0.86-0.92 control values). With hydrel, an insignificant increase in the chloride content was detected, but remained below the 0.5% limit which would have had a negative impact on tobacco quality. References 14: 12 Russian, 2 Western.

12172/9274

UDC 631.811.98

### Use of Plant Growth Regulators on Grain Crops

18410120b Moscow KHIMIYA V SELSKOM  
KHOZYAYSTVE in Russian No 10, Oct 87 pp 33-35

[Article by L.D. Prusakova, doctor of biological sciences, and S.I. Chizhova, candidate of biological sciences, Institute of Plant Physiology, USSR Academy of Sciences]

[Abstract] Recent years have seen an increase in the utilization of synthetic plant growth regulators (such as chlormequat chloride and its derivatives and ethephon) on grain crops due to their efficiency and cost effectiveness. In general, growth retardants inhibit the biosynthesis of gibberellins, resulting in shorter and thicker stems, increased chlorophyll content, enhanced development of root systems, and frequently improved harvests. Studies on plant growth regulators have been conducted at the Institute of Plant Physiology since 1964, involving extensive field trials in Moscow Oblast and Latvia on demovo-podzolic soils with cultivation of spring and winter wheat and spring barley. The use of chlormequat chloride (Chlorocholine Chloride) in conjunction with urea and either ammonium sulfate or nitrate resulted in winter wheat crops showing increased resistance to lodging by 4-5 scale units (Mironovskaya 808 wheat) and increased grain harvests by 12 quintals/ha. The plants were sprayed with 2-4 kg/ha of chlormequat chloride at the end of tillering. No residual quantities of the agent have been detected in plants treated with the doses indicated. Hydrel, another growth regulator even less toxic to rats than chlormequat chloride, has been shown to be slightly

more effective in similar studies. Studies on barley revealed that chlormequat was effective in combination with ethylene biosynthesis promoters in diminishing lodging due to a 16-24% shorter stem length. In addition,

grain yields were increased by 4 quintals/ha following the combined treatment. References 5 (Russian).

12172/9274

**Heat Resistance Characteristics of Rare Earth Element Niobates in High Temperature Region**

18410071 Kiev UKRAINSKIY KHIMICHESKIY ZHURNAL in Russian Vol 53, No 9, Sep 87 (manuscript received 10 Feb 86) pp 906-910

[Article by G.A. Teterin, V.F. Zinchenko, V.Ye. Kuzmin, T.G. Babich, and I.M. Minayev, Physical Chemistry Institute, UkSSR Academy of Sciences, Odessa]

[Abstract] Inorganic materials are being widely used in the form of thin film coatings obtained by electron-beam evaporation under vacuum. To predict the properties of these coatings, it is necessary to study the thermodynamic characteristics of the initial substances in the high temperature region, including that of the molten state. Direct experiments at 2500 K are difficult, and it therefore becomes interesting to estimate the thermal resistance of such compounds on the basis of indirect methods, such as thermodynamic analysis of phase diagrams, analysis of electro-migration parameters, and determination of the degree of donor-acceptor interaction, based on calculations of orbital electronegativity. These methods are used in the present work to estimate the thermodynamic characteristics of rare earth element niobates. Thermodynamic analysis data shows that the relative heat resistance decreases in the series  $\text{Me}_3\text{NbO}_7$ - $\text{MeNbO}_4$ - $\text{MeNb}_2\text{O}_6$ . Yttrium niobate is especially stable and thus appears promising. Electromigrational properties, particularly conductivity, are extremely structure-sensitive characteristics, and therefore, their correlation with thermal stability parameters was established. Electrical conductivity of compressed polycrystalline samples of rare earth element orthoniobates was measured in an oxidizing atmosphere with an R-5021 alternating current bridge at 40 kHz frequency and temperatures up to 1360°C. No hysteresis of temperature as a function of conductivity was observed at temperatures up to 1200°C. Conductivity of orthoniobates changes antipatically with thermal resistance and is also a function of their phase diagram and the crystal structure of the initial substance, making it possible predict the relative thermal stability of single-type compounds from their electrophysical properties in the high temperature region. Analysis of the degree of donor-acceptor interaction in the oxides served as a supplemental method to evaluate the thermal resistance of rare earth niobates. Figures 2; references 9: 7 Russian, 2 Western.

12765

UDC 54-031:537.3:32.1

**Effect of Nonstoichiometry on Electrical Properties of  $\text{GdVO}_3$**

18410039 Donetsk VLIYANIYE NESTEKHIOMETRII NA ELEKTRICHESKIYE SVOYSTVA  $\text{GdVO}_3$  in Russian 1982 (Paper No 2243-82 deposited at VNTI 3 May 82, signed to press 2 Apr 82) pp 1-12

[Article by S.I. Khokhlova, N.M. Stefeyeva; Donetsk State University]

[Abstract]  $\text{GdVO}_3$  was synthesized in atmospheres with different partial pressures of oxygen, and its electrical properties were studied in the 450-1450 K range.  $\text{GdVO}_3$  was found to belong to the p-type order of semiconductors. Conductivity up to 800 K was caused by thermally activated motion of small-radius polarons. Increased oxygen pressure in the synthesis atmosphere increased the concentration of charge carriers and increased electrical conductivity because of the crystallochemical nature of  $\text{GdVO}_3$ , which tends to oxidize, increasing the number of vacancies in the metallic sublattice responsible for the appearance of the  $\text{V}^{4+}$ -3d ion. Determination of the picometric density of samples confirmed the basic role of the annealing atmosphere on formation of non-stoichiometric defects in  $\text{GdVO}_3$ . Figures 3; references 15: 5 Russian; 11 Western.

2791/9274

UDC 541.124.16.546.25-162:543.87

**Reaction of Oxidizing Agents With Diamond Surface**

18410106a Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 296, No 1, Sep 87 (manuscript received 16 Dec 86) pp 118-120

[Article by V.G. Aleshin, G.P. Bogatyreva, B.V. Kruk, and N.V. Novikov, Academician, UkSSR Academy of Sciences, Institute of Superhard Materials, UkSSR Academy of Sciences, Kiev]

[Abstract] Extended X-ray absorption spectroscopy was conducted on the surface of single crystals of synthetic diamond AS6 315/250 to assess the effects of exposure to a variety of oxidizing agents. The data showed that treatment of the surface for one to five minutes with a 30% solution of hydrogen peroxide (75°C), concentrated orthophosphoric acid (160°C), and Cr(VI)-concentrated sulfuric acid (125°C), Mn(VII)-concentrated sulfuric acid (130°C), or concentrated sulfuric acid (195°C) led to an increase in surface oxygen concentration from 27.5 to 33.6%. After doping the surface with 10 keV  $\text{Ar}^+$  under ca.  $5 \times 10^{-4}$  Pa, the concentration of oxygen diminished, and that of carbon increased. Analysis of the patterns of the 1s-electron lines after treatment with the various agents before and after doping with  $\text{Ar}^+$  showed that the asymmetry of the 1s-electron lines of carbon was affected by the agents used in the study, with the exception of phosphoric acid. The findings demonstrated that the surface of a synthetic diamond reacts with oxidizing agents, with the diamond carbon acting as a reducing agent. Figures 1; references 1 (Russian).

12172/9274

UDC 535.34.539.12.04

**Formation of Color Centers in Single  $\text{HfO}_2$  Crystals Following gamma-Irradiation and Heat Treatment**

18410106b Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 296, No 1, Sep 87 (manuscript received 31 Oct 86) pp 121-123

[Article by M.Kh. Ashurov, S.Kh. Batygov, R.A. Rezin, V.V. Osiko, corresponding member, USSR Academy of

Sciences, V.M. Tatarintsev, and P.K. Khabibullayev, corresponding member, USSR Academy of Sciences, Institute of Nuclear Physics, Uzbek SSR Academy of Sciences, Tashkent]

[Abstract] An analysis was conducted on changes in the absorption spectrum at 230-800 nm in single crystals of  $\text{HfO}_2$  induced by either gamma irradiation or heat treatment in order to relate optical changes with defects occurring during crystal growth. The single crystals of  $\text{HfO}_2\text{-TR}_2\text{O}_3$  (TR = Sc, Y, Sm, Gd, Ho, Er, Yb) were irradiated from a Co-60 source with doses reaching  $5 \times 10^6$  R and annealed in a vacuum at 900-2100 K for 0.5 to 8 h. Heat treatment was conducted either in air or pure oxygen at 500 to 2000 K. Evaluation of changes in the absorption spectra showed an increase after heat treatment, and irradiation yielded an additional wide absorption band at ca. 400 nm in both cases. The latter increased with the radiation dosage, reaching a maximum at  $10^5$  to  $10^6$  R. Data interpretation showed that in both cases, the additional absorption could be attributed to induced loss of oxygen from the crystal, leading to the appearance of free electrons and oxygen vacancies, as well as to the transition metals. The latter constitute defects with a high valency state that undergo reduction during vacuum annealing and subsequent filling of the deep vacancies in air, resulting in increased absorption. Figures 2; references 6 (Russian).

12172/9274

UDC 538.22

**Magnetic Properties of Rare Earth Element Molybdates (IV)  $\text{Ln}_2\text{Mo}_2\text{O}_7$  (Ln = Sm, Gd, Y) with Pyrochlore Structure**

18410106c Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 297, No 2, Nov 87 (manuscript received 11 Mar 87) pp 389-392

[Article by G.V. Bazuyev, G.P. Shveykin, corresponding member, USSR Academy of Sciences, T.I. Arbuzova, and V.N. Derkachenko, Institute of Chemistry, Urals Science Center, USSR Academy of Sciences, Sverdlovsk]

[Abstract] Studies were conducted to ascertain the nature of magnetism of rare earth element molybdates (IV)  $\text{Ln}_2\text{Mo}_2\text{O}_7$  with a pyrochlore structure. Specifically, measurements were made of magnetization and magnetic susceptibility over a wide temperature range of polycrystalline samples of  $\text{Sm}_2\text{Mo}_2\text{O}_7$  (I),  $\text{Gd}_2\text{Mo}_2\text{O}_7$  (II), and  $\text{Y}_2\text{Mo}_2\text{O}_7$  (III). Analysis of polytherms of inverse specific magnetic susceptibility of  $\text{Ln}_2\text{Mo}_2\text{O}_7$  (Ln = Sm, Gd, Y) and difference plots,  $1/\chi^I - \chi^{\text{III}}$ , demonstrated that the Curie-Weiss law was met. For I and II, the Curie-Weiss constant  $\theta$  had a positive sign, whereas III was characterized by a negative  $\theta$  constant. In addition, the paramagnetic moment of III was significantly below the theoretical value, and measurements of magnetization at 4.2 K confirmed the absence of a spontaneous

magnetic moment in III. Tabulated data are also presented on the magnetic characteristics of the nonstoichiometric compounds  $\text{Ln}_{1.67}\text{V}_{1.67}\text{Mo}_{0.50}\text{O}_7$  (Ln = Dy, Y). In the case of both compounds, magnetic saturation was not attained at 4.2 K, an observation that was apparently due to marked magnetocrystalline anisotropy. Figures 3; references 11: 4 Russian, 7 Western.

12172/9274

UDC 666.11.01

**Calculation of Optical Constants for Multicomponent Glasses from Data on Binary Systems**

18410106d Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 297, No 2, Nov 87 (manuscript received 6 Mar 87) pp 433-436

[Article by A.K. Yakhkind and G.T. Petrovskiy, corresponding member, USSR Academy of Sciences, State Optical Institute imeni S.I. Vavilov, Leningrad]

[Abstract] Difficulties in determining the index of refraction in relation to the chemical composition of glass are due to the lack of a strict additive relationship between the two parameters. This problem is quite challenging in the case of binary systems, and its complexity increases with multicomponent systems, such as glass. Deviation from additivity is attributed to interaction of the various components, complex formation, polymerization, and the presence of reversible and irreversible chemical systems. A theoretical approach to the determination of certain optical constants, including the index of refraction, from the chemical composition has been advanced by Yakhkind [Stekl. Sostoyaniye, Tr. IV Vses. Soveshch., M.:L. 1965, pp 79-82] on the hypothesis that, in normal and ideal systems, the specific volume is a linear function of, among other things, the volume fraction of each component. The method is applicable to the extent that the experimental system adheres to the empirical Gladstone-Dahl formula, relying on mutually interchangeable components with identical structures:  $A''_m, B''_n = A''_m, B''_n$ , e.g.,  $\text{Me}''_2\text{O} = \text{Me}''_2\text{O}$  (where Me' and Me'' are elements of the first periodic group and  $\text{Ti}_2\text{O}$ ) and allows for extrapolation from binary to more complex systems. The index of refraction in the applicable situations is a linear-fractional function of mole fractions. Comparison of experimental and calculated data for lithium-silicate and lithium-tellurium glasses yielded refraction data with a magnitude of error on the order of 0.001. Figures 2; references 4 (Russian).

12172/9274

UDC 548.735.44

**X-Ray Studies on Gadolinium-Scandium-Gallium Garnet Samples**

18410107a Moscow ZHURNAL NEORGANICHESKOY KHIMII in Russian Vol 32, No 10, Oct 87 pp 2366-2369

[Article by V.A. Yefremov, G.M. Kuzmicheva, S.N. Kozlikin, Ye.V. Zharikov, S.P. Kalitin, and V.V. Osiko, Moscow Institute of Fine Chemical Technology imeni M.V. Lomonosov, All-Union Scientific Research Insti-



tute of Chemical Reagents and Highly Pure Substances, Institute of General Physics, USSR Academy of Sciences]

[Abstract] The unique optical and magnetic properties of rare earth garnets are due to their stoichiometry and cation distribution among nonequivalent crystallographic positions. In view of these considerations, precision X-ray structural analyses were carried out on the stoichiometric single crystals  $Gd_3Sc_2Ga_3O_{12}$  (I) synthesized by the Czochralski method and  $Gd_3Sc_{1-x}Ga_{3+2x}O_{12}$  crystals (II). Determinations of the occupied positions and of the interatomic distances and angles for both crystals led to the conclusion that in I, vacancies occur in the dodecahedral sublattice, and in II, in the octahedral sublattice. Concurrent occurrence of Gd and Sc atoms in the dodecahedral position or partial filling of this position by Ga and the presence of Sc and Ga in the octahedral position lead to a decrease in the interatomic distances in the dodecahedron of I and to a decrease in the interatomic distances in the octahedron in the case of II. The data indicate that, in compounds characterized by the following formulation  $(Gd_3)[Sc_{3-2x}Ga_x]Ga_3O_{12}$ , where  $x = 0.32(2)$ , Sc occupies one octahedral position. With an increase in the value of  $x$ , the concentration of vacancies increases in the dodecahedral position. An alternative explanation may be that there is an increase in the concentration of vacancies with simultaneous distribution of Sc among several cationic positions. References 13: 4 Russian, 9 Western.

12172/9274

UDC 541.123

#### Thermal Stability of $H_xMo_3S_4$ Superconductors

18410107b Moscow ZHURNAL

NEORGANICHESKOY KHIMII in Russian Vol 32, No 10, Oct 87 (manuscript received 19 May 86) pp 2380-2383

[Article by V. Starkov, D.V. Drobot, and Ye.A. Pisarev, Moscow Institute of Fine Chemical Technology imeni M.V. Lomonosov]

[Abstract] A variety of methods were used in analyzing the thermal decomposition of  $H_xMo_3S_4$ , produced by leaching  $Cu_xMo_3S_4$  ( $x = \text{ca. } 1.0$ ) with HCl. Previous studies had suggested that  $Mo_3S_4$  may adsorb hydrogen from air moisture, but that adsorption is limited to particle surfaces since bulk adsorption would result in a change in the transition temperature ( $T_c$ ) for superconductivity. Evaluation of the thermal stability of  $H_xMo_3S_4$  ( $x = 0.4-0.6$ ) in a vacuum or in an inert gas medium leads to the formation of  $Mo_3S_4$  at 160-170°C. At temperatures between 305 and 700°C, a second solid phase appears,  $MoS_2$ , and between 725 and 828°C, a third solid phase ( $Mo_2S_3$ ). Heat treatment in  $I_2$  vapor, which enhances the stability of  $Mo_3S_4$ , results in the formation of  $Mo_4S_5I_{2-x}$ . The latter has a  $T_c$  of 13.5 K, while that of  $Mo_3S_4$  is 1.8 K. Superconducting properties

were not observed for any of the samples derived in the present study, using methods allowing for determination of  $T_c$  above 4K. Figures 2; references 9: 2 Russian, 7 Western.

12172/9274

UDC 548.78.71.65

#### Triple Oxides $La(M_{2/3}Mo_{1/3})O_3$ ( $M = Mn, Mg$ ) With Perovskite Structure

18410107c Moscow ZHURNAL

NEORGANICHESKOY KHIMII in Russian Vol 32, No 10, Oct 87 (manuscript received 17 Apr 86) pp 2550-2553

[Article by G.V. Bazuyev, O.V. Makarova, and G.P. Shveykin, Institute of Chemistry, Urals Science Center, USSR Academy of Sciences]

[Abstract] The demonstration that compounds with the cationic combination  $Mn^{2+}Mo^{5+}$  possess specific electrical and magnetic properties led to studies on additional systems with such stable combinations. Triple oxides of the  $La(M_{2/3}Mo_{1/3})O_3$  type were synthesized in a vacuum from  $La_2O_3$ , MO ( $M = Mn, Mg$ ),  $MoO_3$ , and metallic Mo for evaluation of heat effects, magnetic susceptibility, and resistivity. X-ray analysis demonstrated that both compounds possessed the structure of a rhombically distorted perovskite. The degree of distortion in the Mg compound was greater than in the Mn compound, and both underwent decomposition at 850-900°C. The temperature vs. 1/magnetic susceptibility plots for the Mn compound followed the Curie-Weiss law only above 550 K; at lower temperatures, deviation from linearity was similar to that reported for  $Y_2(Mn_{2/3}Mo_{1/3})O_7$  [Bazuyev, et al., Zhurn. Neorgan. Khimii, 29(4):875, 1984]. The corresponding plots for the Mg compound showed an inflection point at 760 K. In addition, both compounds behaved as semiconductors, with  $\rho$  values for the Mn and Mg compounds calculated at  $1.5 \times 10^2$  and  $1.10^3$  ohm cm, respectively. Figures 1; references 6: 2 Russian, 4 Western.

12172/9274

UDC 661.862.22+536.421

#### Oxidation of Aluminum Nitride Powder by Pulsed Laser Heating

18410107d Moscow ZHURNAL

NEORGANICHESKOY KHIMII in Russian Vol 32, No 10, Oct 87 (manuscript received 10 Mar 86) pp 2576-2577

[Article by D.V. Fedoseyev, G.N. Khrustaleva, A.V. Lavrentyev, I.G. Varshavskaya, and G.M. Plavnik, Institute of Physical Chemistry, USSR Academy of Sciences]

[Abstract] X-ray diffraction analysis was conducted on the oxidation products obtained by laser treatment of aluminum nitride powder and rapid cooling. The experimental setup utilized an infrared laser (1.06  $\mu\text{m}$ ), which

was focused on a column of filling powder by a quartz lens to give a maximum temperature of 2100 K and a subsequent cooling rate of  $10^6$  K/s once the powder had passed the focal point. The diffraction data provided evidence for the formation of  $\alpha$ - $\text{Al}_2\text{O}_3$  (corundum) and  $\gamma$ - $\text{Al}_2\text{O}_3$ . Although the latter is stable only to temperatures of 1000° C and undergoes transition at higher temperatures into the  $\alpha$ -phase, its detection in the present study was attributed to rapid cooling. Experiments conducted in nitrogen to avoid oxidation also yielded distinct patterns at 0.223 and 0.162 nm and an unexpected interplanar distance of 0.309 nm. The latter observations supported the occurrence of a cubic lattice similar to that of boron nitride. Figures 1; references 2 (Russian).

12172/9274

UDC 543.422+621.789

**Laser-Induced Changes in Chemical Composition of Metal Surface Coated with Absorbent**

18410108a Moscow POVERKHNOST: FIZIKA, KHIMIYA, MEKhanika in Russian No 10, Oct 87 (manuscript received 22 Jan 87) pp 130-134

[Article by V.I. Nefedov, A.R. Vinogradov, A.N. Sokolov, V.P. Sanygin, N.A. Generalov, V.P. Zimakov, and N.G. Solov'yev, Institute of General and Inorganic Chemistry, USSR Academy of Sciences, Moscow]

[Abstract] X-ray photoelectronic spectroscopy, X-ray fluorescence spectroscopy, and electron microprobe analysis were used to monitor changes in the chemical composition of a metal surface (steel St3) induced by laser irradiation of polymethylsiloxane-coated surfaces. The changes were monitored to depths of ca. 200  $\mu\text{m}$  with the various analytical techniques, following exposure to a  $\text{CO}_2$  laser. The data showed that heating of the thin film coating leads to disruption of Si-C bonds and, partially, Si-O bonds, subsequent oxidation of the products, and melting of the metal surface. The products from the organic film enter the melted layer of the metal via diffusion and convective mechanisms. The Si/O and Si/Fe ratios in the melted layer showed a time-related increase in oxygen-bound Si in the more superficial layers and pure Si in the deeper layers. The Si2p bond energy in the superficial layers was on the order of 103 eV (corresponding to Si-O compounds), and at a depth of ca. 2  $\mu\text{m}$ , 100 eV. Similar data on the penetration of Si into the metal were provided by Si/C profiles. The depth

of Si penetration into Fe was ca. 110  $\mu\text{m}$ , with Si reaching a concentration of ca. 0.25 wt. percent. Addition of powdered boron and graphite to polymethylsiloxane led to similar enrichment of the metal surface layer with boron and C, demonstrating that concomitant doping with several elements—in addition to Si—is possible by this method. Figures 6; references 4 (Russian).

12172/9274

UDC 537.531.039.2

**Electronic Excitation in Ionic Crystals Subjected to Plastic Deformation**

18410108c Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIYE NAUKI in Russian Vol 27, No 5, Sep-Oct 87 pp 73-76

[Article by V.A. Zakrevskiy and A.V. Shuldiner, Engineering Physics Institute imeni A.F. Ioffe, USSR Academy of Sciences, Leningrad]

[Abstract] Electron and photon emissions were analyzed for alkaline metal halides subjected to plastic deformations so as to evaluate the effects of mechanical stress on the electronic system of solid bodies. Analysis of emission and luminescence was conducted on single LiF and NaF crystals subjected to compression at a rate of ca.  $10^{-3}\text{s}^{-1}$  at room temperature in a vacuum ( $10^{-6}$  to  $10^{-7}$  Pa). Electron and photon emission were first detected when  $\epsilon$  reached ca. 2%, where  $\epsilon$  is the relative sample deformation, representing the intersection of slippage planes and pronounced localized mechanical stresses. Thermostimulated and photostimulated emissions of the deformed samples indicated the appearance of F-type centers. Studies of deformation luminescence spectra of LiF resulted in the identification of two maxima at ca. 280 and ca. 400 nm, similar to spectra obtained with X-ray fluorescence. The peak at 280 nm was attributed to recombination of the mobile "holes" with localized electrons at F sites, while the peak at the longer wavelength was ascribed to impurities. The data demonstrated that deformation of alkaline metal halides results in accrual of both elastic energy as well as in electronic excitation. Release of this energy as a result of radiationless destruction in the deformed crystals is analogous to that of a radiation shock and is followed by pronounced temperature fluctuations. Figures 1; references 20: 13 Russian, 7 Western.

12172/9274

### Mass Spectra of Positive and Negative $\text{SF}_6$ Ions at High Pressures

18410072d Moscow *KHIMIYA VYSOKIKH ENERGIY in Russian* Vol 21, No 5, Sep-Oct 87 (manuscript received 24 May 76) pp 392-396

[Article by G.V. Karachevtsev and A.Z. Marutkin, Moscow Engineering Physics Institute]

[Abstract] Sulfur hexafluoride is widely used as a gaseous dielectric because  $\text{SF}_6$  molecules are very efficient in capturing slow electrons. Fluorine-containing negative molecules are also used in ion-plasma technology and as a source of active fluorine atoms in chemical lasers. In the present work, the mass spectra of positive and negative sulfur hexafluoride ions in a mixture with air were measured in an ionization chamber at 66-267 Pa pressure in a MKh-1320 mass spectrometer modified with a PMKh-2 chemical ionization adapter. Relationships of the spectra to electron emission current, electron energies, the electrical field in the ionization region, and gas pressure were used to obtain kinetic information on ion-molecular reactions.

12765

### Photo Overcharge of Rare Earth Ions in Glass and Metastable Valence Form of Activator

1841072c Leningrad *FIZIKA I KHIMIYA STEKLA in Russian* Vol 13, No 4, Jul-Aug 87 (manuscript received 2 Apr 86) pp 581-587

[Article by V.I. Arbutov, M.N. Tolstoy, M.A. Elerts, and Ya.S. Trokis, Institute of Inorganic Chemistry, LaSSR Academy of Sciences, Salaspils]

[Abstract] Rare earth ions of variable valence may be incorporated into a glass in one of their possible charged states either in the stable valence form, by establishing definite oxidizing or reducing conditions during the glass founding stage, or in the metastable form, by overcharging with radiation. In this case, the degree to which the spectral-luminescent properties may differ for an activator present in one or another charged state in a glass of single composition but characterized by the fact that its immediate surroundings, especially the quantity and disposition of ligands, in the first instance corresponds to the equilibrium state of the glass at its glassification temperature, and in the second to the nonequilibrium state. In the present work, a comparison was made of absorption and luminescent spectra of europium and cerium ions in stable and metastable states in glass. Activator selection was contingent on the fact that its various charged states could be realized in the glass both during the founding stage and by overcharging. The spectra of optical electron transfer in absorption between the 4f-state and the charge transfer state in photo overcharged (metastable)  $(\text{Ce}^{3+})^+$  ions are shifted approximately 0.6 eV towards the low energy side in comparison to the spectra of stable  $\text{Ce}^{4+}$  ions. The f-d absorption spectra of photo overcharged  $(\text{Ce}^{4+})^+$  and  $(\text{Eu}^{3+})^+$  ions are

shifted 0.10-0.15 eV to the low energy side in comparison to the spectra of their stable analogues,  $\text{Ce}^{3+}$  and  $\text{Eu}^{2+}$ . Trivalent europium has f-f luminescence both in the stable and metastable states. The observed spectral-luminescent characteristics of activator ions in the metastable state are evidently due to the fact that the surroundings nearest to the activator ion after photo overcharging respond to the initial and not the new charge of the activator, i.e., they are not in equilibrium for its new charge. Figures 4; references 19: 15 Russian, 4 Western.

12765

### Effect of Third Component and Synthesis Conditions on Spectral-Luminescent Properties of Quartz Glasses Containing Rare Earth Elements

18410072b Leningrad *FIZIKA I KHIMIYA STEKLA in Russian* Vol 13, No 4, Jul-Aug 87 (manuscript received 16 Oct 85) pp 554-560

[Article by T.I. Prokhorova, E.L. Demskaya, and O.M. Ostrogina, State Scientific Research Institute of Quartz Glass]

[Abstract] The widespread use of quartz glasses doped with rare earth elements in modern electronic-optical components and laser technology poses new problems in elucidating the effects of various technological factors on the valency state of the activator in the quartz glass, which in turn determines the operational spectral-luminescent properties of the material. In the present work, a study was made of the effects of a third component and the synthesis conditions on the valency of europium, samarium, and ytterbium in quartz glasses. The purpose of the work was to determine the possibility of obtaining luminescent quartz glasses activated with rare earth ions in the required valency configuration. Absorption and luminescence spectra for quartz glasses doped with Eu, Sm, and Yb oxides and aluminum (or alkali metal) oxide are presented. All rare earth elements present in the glasses, with or without the presence of the third component, were found to exist simultaneously in two valency states ( $\text{Ln}^{2+}$  and  $\text{Ln}^{3+}$ ). The equilibrium balance between the two states is a function of the glass melting conditions and the third component type (aluminum oxide or alkali metal oxide). Figures 3; table 1; references 13 (Russian).

12765

### Electron-Cation Recombination in Multi-Atom Buffer Gas

18410072a Moscow *DOKLADY AKADEMII NAUK SSSR in Russian* Vol 296, No 5, Oct 87 pp 1138-1140

[Article by G.A. Abakumov, V.B. Kolovski, B.I. Polyakov, and A.P. Simonov, presented by Academician Y.M. Kolotyrkin, Scientific Research Physical Chemistry Institute imeni L.Ya. Karpov, Moscow]

[Abstract] High concentrations of electrons and positively charged ions are known to be formed during laser excitation of molecules as a result of sequential and



multi-photon ionization. In contrast to atoms and simple molecules, the recombination of electrons with the cations of complex organic compounds in the gaseous phase has not yet been studied, especially under triple-reaction conditions of an ion-electron-buffer gas molecule. In this work, results are presented for the first time on experiments to determine the coefficient of recombination  $k$  of electrons with molecular cations of the complex organic compound 2,5-diphenylfuran (PPF) at constant high pressure of the buffer gas (pentane). The two-step photoionization of the PPF molecule through an intermediate electron-excited singlet  $S_1$ -state was achieved by irradiation of XeCl with a pulsed excimer laser at a 308 nm wavelength and a 10 nanosecond pulse duration. The gas mixture ( $10^{-2}$  Torr PPF and 700 Torr pentane partial pressures) was placed in a sealed quartz cuvette containing rectangular nickel electrodes 10 X 50 mm, spaced 10 mm apart. The laser beam was directed through a 5 X 5 mm quartz diaphragm into the electrode gap parallel to the long side of the electrodes. The number of charged particles was recorded by means of the photoconductivity current formed as a result of their drifting under the weak external direct electric field between the electrodes. In special experiments measuring the flight time of the charged particles, it was established that electron drift in pentane takes place without capture by the buffer gas or PPF molecules. Also, the electrons formed during photoionization lose excess energy through collision with pentane molecules over a time span much less than that of the time of measurement. Therefore, the charged particles acting in the recombination process are thermal electrons and PPF cations. Typical photoconductivity vs. time curves are hyperbolic in shape. The coefficient of electron-cation recombination  $k$ , determined from photocurrent quenching curves, has a value of 4.5 plus or minus  $0.9 \times 10^{-3}$  cm<sup>3</sup>/s. This value exceeds by several orders of magnitude the known coefficient of dissociative recombination of thermal electrons for both simple molecules and weakly bound complexes. The above recombination process must thus be taken into account during interpretation of results in experiments on excitation of impurity molecules in the buffer gas of laser beams. Figures 2; references 7: 6 Russian, 1 Western.

12765

**Electron Excitation Spectra and Inherent Luminescence of Bismuth Germanate and Silicate**  
18410085a Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 296, No 2, Sep 87 (manuscript received 31 Dec 86) pp 395-399

[Article by V.A. Pustrovarov, Yu.F. Kargin, A.V. Kruzhalov, A.A. Maslakov, V.M. Skorikov, B.V. Shulgin, and V.R. Kargin, Institute of General and Inorganic Chemistry imeni N.S. Kurnakov, USSR Academy of Sciences, Moscow; Urals Polytechnic University imeni S.M. Kirov, Sverdlovsk]

[Abstract] Recently, bismuth germanate and silicate have been actively investigated. In addition to excellent acousto-optical properties, these compounds possess

unique scintillation characteristics. Nevertheless, there is little information available about the luminescent properties of these crystals in the visual and near ultraviolet regions of the spectrum. In the present work, the optical properties of electronic excitation of  $\text{Bi}_4\text{Ge}_3\text{O}_{12}$  and  $\text{Bi}_4\text{Si}_3\text{O}_{12}$  in the 3-36 eV region are presented. The experiments were conducted, using the synchrotron channel of the Vepp-2M Accelerator at the Institute of Nuclear Physics, Siberian Department, USSR Academy of Sciences. Analysis of the absorption and reflection spectra indicated that the germanate at an energy greater than 4.2 eV and the silicate above 4.4 eV display fundamental absorption and direct transitions. The temperature dependence of reflection demonstrated the formation of exciton states at the fringe of the fundamental absorption. The crystals possess intense luminescence with maxima at 2.45 eV for the germanate and 2.5 eV for the silicate. At energies above 9.8 eV, the luminescence yield increased, due to multiplication of electron excitation. The crystals have a high quantum yield with no excitation in the region of transparency for the basic substance and a decreased quantum yield when impurities or radiation defects are present. Cooling to 80 K increases the luminescence yield uniformly for the formation of both excitons and electron-hole-pairs. The inherent luminescence of the compounds arises from recombination and relaxation processes. Figures 4; references 8: 2 Russian, 6 Western.

12126

UDC 541.139+535.372

### Magnetic Effects in Gas Phase Reactions

18410018b Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIYE NAUKI in Russian No 4, Jul-Aug 87 (manuscript received 10 Dec 86) pp 26-34

[Article by N.M. Bazhin, Institute of Chemical Kinetics and Combustion, Siberian Department, USSR Academy of Sciences, Novosibirsk]

[Abstract] A survey of the literature concerning magnetic field effects on luminescence and gas phase reactions of organic and inorganic compounds is presented and discussed. Most studies of diatomic molecules have involved iodine.  $\text{I}_2$  luminescence was extinguished effectively by a magnetic field effect while the effectiveness of quenching dropped with an increase in pressure in the system. The general principles of magnetic field effects on polyatomic molecules are listed. Studies of magnetic field effects on triatomic molecules  $\text{NO}_2$ ,  $\text{CS}_2$ , and  $\text{SO}_2$  showed that they have similar characteristics and that the electronic spectra of their molecules are very complex. Each of these compounds is discussed separately. Study of photochemical reactions of formaldehyde and glyoxal in magnetic fields showed that magnetic effects on the fluorescence of both these molecules are similar. These effects are described. The data presented show the scale of the magnitude of magnetic field effects on

photochemical reactions in the gas phase; it usually does not exceed 30%. Theoretical models of the phenomena observed leave much to be explained. Figures 4; references 86: 5 Russian, 81 Western.

2791/9274

UDC 546.87'.24

**Isothermal Cross Section of Phase Diagram of  $\text{Bi}_2\text{O}_3\text{-TeO}_2$  System at 500° C**

18410109a Moscow ZHURNAL  
NEORGANICHESKOY KHIMII in Russian Vol 32, No  
10, Oct 87 (manuscript received 13 May 86) pp  
2558-2562

[Article by L.N. Kholodkovskaya, V.A. Dolgikh, B.A. Popovkin, and A.V. Novoselova, deceased, Moscow State University imeni M.V. Lomonosov]

[Abstract] The goal of this work was to find new phases in the system  $\text{Bi}_2\text{O}_3\text{-BiI}_3\text{-TeO}_2$ , using the X-ray phase analytical method. An isothermal cross section of the phase diagram was constructed for the 500° C case, revealing another bismuth oxiodide in addition to those described earlier, with the composition  $\text{Bi}_2\text{O}_3(0.35 \text{ plus or minus } 0.017), \text{BiI}_3(0.05 \text{ plus or minus } 0.002) \text{TeO}_2(0.60 \text{ plus or minus } 0.07)$ . Concerning the question of whether the bismuth-tellurium-oxiodides are centro-symmetric or acentric, they were tested for their ability to generate the second harmonic (GSH) of a laser beam passing through them and for the presence of isoelectric resonance lines in nuclear quadrupole resonance spectra. These lines were observed only in the phase II spectrum, and this was the only material to generate the second harmonic at room temperature (0.5

units in reference to a quartz standard). With temperature elevation to 190 plus or minus 10° C, the GSH signal disappeared, probably because of the transition of its crystalline structure into a centro-symmetric state. Figure 1; references 6: Russian.

7813/9274

UDC 541.117+535.338.42

**IR Spectra of Reaction Products of Yb Atoms With HCl Molecules in Argon Matrices**

18410109b Moscow VESTNIK MOSKOVSKOGO  
UNIVERSITETA: SERIYA 2. KHIMIYA in Russian  
Vol 28, No 5, Sep-Oct 87 (manuscript received 2 Jun 86)  
pp 436-440

[Article by S.B. Osin, Department of Physical Chemistry, MGU]

[Abstract] An attempt was made to synthesize YbCl molecules from the reaction of Yb with HCl in argon matrices. Analysis of IR spectra showed that a series of compounds was formed: the most intense bands were at 329, 696, and 1292  $\text{cm}^{-1}$ , all of which were related to different compounds. The 329  $\text{cm}^{-1}$  band was assigned to the YbCl molecule. The bands in the region 1300-1200  $\text{cm}^{-1}$  were related to Yb-H vibrations from several possible products: YbH,  $\text{HYbCl}$ ,  $\text{YbH}_2$ ,  $\text{YbHCl}_2$ , etc. It was difficult to assign a molecular or ionic status for the  $\text{HCl}_2$  entity on the basis of IR-spectroscopy; but, on the basis of IR spectroscopic data alone, it was believed to have been electroneutral. Additional work is needed to elucidate the mechanism of this reaction. Figures 3; references 10: 3 Russian, 7 Western.

7813/9274



**Interview with Academician E.Y. Lukevits, Soviet Organometallic Chemist**

18410110 Riga NAUKA I TEKHNIKA in Russian No 10, Oct 87 pp 2, 6-8

[Article by D. Sarma]

[Abstract] An interview with Academician Edmund Yanovich Lukevits is reported. He was born 14 Dec 36 in Liyepaye, where he went to school. After secondary education, he studied at Latvian State University. His interest in organosilicon chemistry began early during his studies. In 1958, he graduated from the University and in 1970, became the head of the Laboratory of Organometallic Compounds. In 1973, he received a doctorate degree and began his studies of biologically active organosilicon compounds. In 1979, he became a full professor and last year — an academician and member of the Presidium of the Academy. Recently, his interests switched to organogermanium compounds. He has published 622 papers, 15 books, and 17 inventions. His early work concerned silicon and germanium reactions with unsaturated compounds in search for thermally stable lubricants. Next, his interest turned to biologically active compounds in which, by substituting silicon for carbon, he was searching for new activities. Basically, he was a synthetic chemist, specializing in the application of silicon chemistry to biologically active agents (antibiotics and pesticides). Recently, he introduced nuclear magnetic resonance technology to study organosilicon compound structures. He apparently is approaching synthesis of a connective tissue-stimulating agent. His germanium derivatives are less toxic than the silicon reagents and have many interesting properties. Other work directed by him is in the area of prostaglandins, immunopeptides, interferon and interleukins. The most recent addition to his organization is the Laboratory of Medicinal Chemistry. Figures 4.

7813/9274

UDC 541.67+548.737

**Synthesis and Crystalline Structure of 1,1-bis(1-silatranyl)ethane**

18410121 Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 297, No 1, Nov 87 (manuscript received 19 Feb 87) pp 108-111

[Article by Yu.E. Ovchinnikov, T.G. Kovyazina, V.Ye. Shklover, Yu.T. Struchkov, V.M. Kopylov, and M.G. Voronkov, corresponding member, Institute of Elemental Organic Compounds imeni A.N. Nesmeyanov, USSR Academy of Sciences, Moscow]

[Abstract] X-ray structural analysis was conducted on 1,2 bis(1-silatranyl)ethane (I), synthesized by an ester interchange between 1,2-bis(triethoxysilyl)ethane and triethanolamine (1:2) in boiling xylene for 75 h. Following recrystallization from hot dimethylformamide and drying in a vacuum (2 mm Hg) at 90° C, I was obtained in the form of colorless crystals at a yield of 24.3%. The crystals of I decompose at temperatures above 320° C, are insoluble in water, ethanol, acetone, benzene, and toluene, and are poorly soluble in dimethylformamide and chloroform. Atomic coordinates and bond lengths in I are summarized in tabular form. The centro-symmetry of I is due to the trans configuration of the SiCCSi fragment, with the plane of this fragment showing a C<sub>1</sub>C<sub>1</sub>SiO<sub>3</sub> torsion angle of 163° relative to the planes of the five-membered SiOCCN rings. The length of the trans-annular donor-acceptor Si-N bond is 2.230 Angstroms, while the distance from the Si atom to the equatorial plane of the bound oxygen atoms is equal to 0.24 Angstroms. Figures 1; references 8: 4 Russian, 4 Western.

12172/9274

**Electron-Donor and Acceptor Functions of Physiologically Active and Model Compounds. X. Electron-Donor Functions of O-Methylchloroformimine-O-ethylmethylphosphonate**

18410087a Leningrad ZHURNAL OBSHCHEY KHIIMIY in Russian Vol 57, No 9, Sep 87 (manuscript received 13 Aug 86) pp 2073-2077

[Article by O.A. Rayevskiy, V.Yu. Grigoryev, V.P. Solovyev, A.N. Ivanov, V.B. Sokolov, and I.V. Marmynov, Institute of Physiologically Active Substances, USSR Academy of Sciences, Chernogolovka]

[Abstract] Phosphorylated alkylchloroformoximes can be regarded as analogues of the known pesticide valexon. For this reason, a new synthetic method was developed for phosphorylated alkylchloroformoximes, and some of their physicochemical properties were studied. The thermodynamic values of hydrogen bonded complexes between O-methylchloroformimine-O-ethylmethylphosphonate (I) and various electron acceptor compounds were determined by IR spectroscopy and calorimetry in hexane at 298 K. I was synthesized via the reaction of O,O-diethylmethylphosphonate with 1,1-dichloro-1-nitromethane. Phenol, diphenylamine, aniline, and urethane were used as electron acceptors. The IR band for the OH group on phenol was shifted  $309\text{ cm}^{-1}$  lower upon complexing with I, which was similar to observations of complexation of phenol with phosphonates, containing a halomethyl group on the phosphorus atom. Diphenylamine, aniline, and urethane demonstrated NH-band complexing shifts of  $47\text{-}180\text{ cm}^{-1}$ . The enthalpy of complex formation was greatest for aniline and least for urethane. Complex stability constants were calculated from the dependence of absorption intensity on concentration. The log of the constant for diphenylamine was approximately twice that of aniline, due to the contribution of the entropy factor. Log K,  $\Delta H$ ,  $\Delta S$ , and  $\Delta G$  were determined by both spectrophotometric and calorimetric methods. Comparison of the results indicated that the spectrophotometric method gives acceptable results, often more precisely than calorimetry. The data also demonstrate that complexation of I with phenol is preferred over the other compounds tested. Aniline forms a stronger complex than diphenylamine or urethane. Urethane forms cyclic dimers and monomer

and dimer complexes with I. One may conclude that the oxime group of I plays a significant role in complexation. References 16: 14 Russian, 2 Western.

12126

**Synthesis, Structure, and Anticholinesterase Activity of Certain Organophosphorus Anabasine Derivatives**

18410087b Tashkent KHIIMIYA PRIRODNYKH SOYEDNENIY in Russian No 4, Jul-Aug 87 (manuscript received 6 Jan 87) pp 561-565

[Article by D.N. Dalitov, M.B. Gafurov, F.G. Katayev, and A.A. Abduvakhobov, Institute of Bioorganic Chemistry, UzSSR Academy of Sciences, Tashkent]

[Abstract] A study was conducted on the structure and anticholinesterase activity of compounds obtained from the reaction of O-alkylmethylthiophosphonic acid chlorides with optically active N-beta-hydroxyethylanabasine in order to elucidate the effects of the anabasine derivative on the diastereomeric anisochronicity of O-alkyl-O-[N-(beta-hydroxyethyl)anabasinyl]ethylthiophosphonates. IR and NMR spectroscopy were used to confirm the structure. Double resonance demonstrated the nonequivalence of the N-CH<sub>2</sub> protons. Splitting of the PCH<sub>3</sub> methyl and ethyl radical signals and of the  $\alpha'$ -proton, with broadening of the other piperidine proton signals, was temperature independent. This splitting was due to the presence of the two diastereomers. Anticholinesterase properties of the five compounds synthesized were measured with human erythrocyte acetylcholinesterase and horse serum butyrylcholinesterase, using the Ellman method. All five compounds synthesized were reversible competitive inhibitors of the enzymes. Increasing the alkyl substituent length from ethyl to amyl had little effect on antiacetylcholinesterase activity, indicating that the phosphonyl group is poorly sorbed on the hydrophobic portion of the enzyme active surface. For butyrylcholinesterase, increasing alkyl chain length from ethyl to butyl increased inhibitory activity by a factor of 43. Amyl and isobutyl derivatives had decreased activity by an order of magnitude. This agrees with literature reports that this enzyme is characterized by hydrophobic interactions. Except for the ethyl derivative, all others are selective for the butyryl enzyme, with selectivity increasing with O-alkyl chain length. Figures 1; references 10: 8 Russian, 2 Western.

12126

**Chemiluminescence of 1,2-Dioxetanes — Products of the Photosensitized Oxidation of Triallate**

18410088 Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA KHIMICHESKAYA in Russian No 9, Sep 87 (manuscript received 13 Aug 86) pp 2016-2019

[Article by A.I. Voloshchin, G.L. Sharinov, V.P. Kazakov, and G.A. Tolstikov, Institute of Chemistry, Bashkir Department, USSR Academy of Sciences, Ufa]

[Abstract] One of the possible pathways for degradation of herbicides in plants is oxidation by singlet oxygen which forms with the participation of the natural sensitizer chlorophyll A. In order to model the process of triallate (N,N-diisopropyl-S-(2,3,3-trichloroallyl) thiocarbamate) degradation, it was subjected to photo-oxidation in chloroform, containing chlorophyll A and methylene blue. According to thin layer chromatography, the oxidation leads to two products, one of which is only present in trace amounts and could not be identified. The major product was identified as the acid chloride, which is a product of the breakdown of the intermediate dioxetane. Dioxetane formation was demonstrated by following the chemiluminescence of the reaction mixture. On semilog paper, the dependence of chemiluminescence intensity exhibited two linear portions, corresponding to the monomolecular breakdown of two products — dioxetane and possibly its corresponding acid chloride with an oxygen on the sulfur atom. However, since sulfur oxidizes more slowly than a double bond, these products will form to a lesser extent. Calculation of decomposition constants indicated that the SO dioxetane is less stable than the S dioxetane. One may conclude that degradation of the herbicide triallate under the influence of singlet oxygen proceeds via unstable 1,2-dioxetanes, which cleave with accompanying chemiluminescence to form acid chlorides and phosphine. Figures 1; references 9; 2 Russian, 7 Western.

12126

UDC 656.7.076:63

**Concurrent Application of Complex Liquid Fertilizers With Herbicides on Rice Fields**

18410111 Moscow VOZDUSHNYY TRANSPORT in Russian No 9, Sep 87 pp 17-19

[Article by A.G. Korovyanskiy, S.I. Rybachenko, K.M. Avakya, V.K. Sapelkin, and A.S. Khalchenko]

[Abstract] Aviation technology was developed for concurrent application on rice fields of complex liquid fertilizers (10-34-0), which contain 10% nitrogen and 34% phosphorus, and the herbicides saturn and propamide. An M-2 helicopter was used in this trial. For effective administration, herbicides should be diluted with water to a 1:3 ratio and added in small portions to the complex fertilizers while continuously stirring the solution. The working period is about one hour, after

which caking or precipitation occurs, clogging the spraying apparatus. Combined application was as effective as individual application of each component.

7813/9274

UDC 632.95

**Photochemical Transformation of Phosphonates**

18410122a Moscow AGROKIMIYA in Russian No 10, Oct 87 (manuscript received 30 Oct 86) pp 87-95

[Article by M.A. Khisenko, D.B. Girenko, and Z.A. Leyka, All-Union Scientific Research Institute of Hygiene and Toxicology of Pesticides, Polymers, and Plastics, Kiev]

[Abstract] In order to stimulate degradation of pesticides in the environment, laboratory studies were conducted on the degradation of the phosphonic acid esters aphos, trakephon, and butonate by ultraviolet light (250-300 nm). The studies were conducted with ethanol, distilled water, or hexane solutions ( $1.2-1.5 \times 10^{-2}$  g/mol per liter) at 25° C, with an illumination energy of 300  $\mu$ W/cm<sup>2</sup>. The degradation products were monitored by a variety of conventional chemical techniques, leading to the construction of a sequential degradation scheme for each compound into simpler compounds. Rate constants and quantum yields for the decomposition reactions are tabulated, showing that aphos was most rapidly degraded in ethanol, butonate in water, and trakephon about equally in hexane and water, but not in water. In general, the key mechanism involved the formation of a phosphonyl radical — [(RO)<sub>2</sub>PO] — which facilitated removal of H atoms and eventual breakdown of the molecule along the major RO-P, P-C, and C-C bonds. Figures 7; references 13 (Russian).

12172/9274

UDC 632.95

**Synergism in Insecticides and Its Potential Applications in Insect Control**

18410122b Moscow AGROKIMIYA in Russian No 10, Oct 87 pp 116-130

[Article by N.M. Slynko and I.N. Leonova]

[Abstract] A literature survey is presented of the problems attendant to the occurrence of insecticide resistance and of the methods used to overcome such complications. A well established approach in agriculture relies on the use of a combination of insecticides, based on the fact that simultaneous resistance to two agents has a very low probability of occurrence. However, the disadvantages of the latter approach involves, among other things, an ecological risk of the disappearance of desirable species, as well as of the elimination of pests. More recent attempts at effective insect control have utilized the phenomenon of synergism: the combination of chemical agents that, in conjunction with insecticides,

enhances the toxicity of the latter. The synergistic agents may act to modify the ingress, distribution, and biotransformation of the insecticide in such a manner as to render it more effective. In most cases, however, synergism involves diminished metabolic detoxification of the insecticide through inhibition of one or more of the primary enzyme systems responsible for metabolic transformation. The systems that are usually depressed by the synergists consist of microsomal cytochrome P-450-dependent monooxygenases, nonspecific esterases, and glutathion S-transferase conjugating enzymes. In general, the best synergists have common structural features with the insecticide in question, as demonstrated in the potentiation of bromophos by various organophosphorus compounds. References 141: 4 Russian, 1 Chinese, 1 Korean, 1 Polish, 1 Romanian, 133 Western.

12172/9274

UDC 547.398.1

**Synthesis and Biological Activity of  
3-Amino-2-Hydroxypropyl Ester Salts of Pimaric  
Acid**

18410122c Minsk VESTSI AKADEMII NAVUK BSSR  
SERYYA KHIMICHNYKH NAVUK in Russian No 5,  
Sep-Oct 87 (manuscript received 15 Jul 85) pp 44-48

[Article by A.S. Degtyarenko, T.I. Pekhk, S.A. Makhnach, and K.F. Smirnova, Institute of Physical Organic Chemistry, Belorussian SSR Academy of Sciences, Minsk; Institute of Chemical and Biological Physics, Estonian SSR Academy of Sciences, Tallinn]

[Abstract] The demonstrated antimicrobial and antifungal activities of water-soluble 3-amino-2-hydroxypropyl esters of dihydroabietic acid led to the synthesis and biological testing of the corresponding pimarate esters. The initial synthetic steps involved synthesis of glycidyl pimarate in an 89-90% yield by the reaction of sodium pimarate with alpha-epichlorhydrin and sodium hydroxide (1:20:0.25) at 110° C for 6 h. The 3-amino-1 (1 = -2-hydroxypropyl pimarate) compounds were synthesized by reaction of the glycidyl pimarate with a secondary amine (1:2) in a 96% ethanol solution for 8 h at 60° C with mixing. The biological activities of the resultant

compounds (3-piperidino-1, 3-morpholino-1, 3-diethylamino-1, 3-diethanolamino-1) were studied at the All-Union Scientific Research Institute of Chemical Plant Protection. The resultant data showed that the iodomethylates of 3-morpholino-1, 3-diethylamino-1, and the methyl sulfate of 3-diethylamino-1 possessed marked antibacterial activity with respect to *Xanth. malv.* In addition, the iodomethylate of 3-piperidino-1 was active against the fungus *Fus. monilii*, and that of 3-diethanolamino-1 against *Phiz. sol.* The fungicidal activities of these compounds against gray rot of beans, powdery mildew of cucumbers, and tomato phytophthora were weak. None of the compounds provided any evidence of acaricidal or plant growth regulating activities. References 3: 2 Russian, 1 Western.

12172/9274

UDC 632.95

**Novel Fungicide and Disinfectant of Sugar Beet  
Seeds**

18410122d Moscow KHIMIYA V SELSKOM  
KHOZYAYSTVE in Russian No 10, Oct 87 pp 76-77

[Article by Ye.I. Andreyeva, doctor of agricultural sciences, S.S. Kukalenko, doctor of chemical sciences, T.S. Pronchenko, candidate of agricultural sciences, V.P. Brysova, candidate of chemical sciences, and K.F. Smirnova, All-Union Scientific Research Institute of Chemical Plant Protection]

[Abstract] Extensive laboratory, hothouse, and field trials were conducted to determine the efficacy of boletin as a fungicide and disinfectant suitable for use on sugar beets. Boletin is an agent insoluble in water and poorly soluble in organic solvents and is marked by low toxicity for rats (LD<sub>50</sub> = 300 mg/kg). The tabulated data demonstrate its efficacy under a variety of experimental conditions against fungi affecting the root system, sprouts, and mature plants; it had no effect on seed germination. Comparison with well-established agents showed equivalent or better potency and no accumulation in the plants. Over a period of four years, there was no onset of resistance to boletin among *Botrytis cinerea* or *Cercospora beticola*, indicating that boletin may have the potential for use on sugar beet fields. References 2 (Russian).

12172/9274



UDC 662.74(047)

**Combined Session of Scientific Council of State Committee for Science and Technology on Problem Topic: "Novel Processes in Coke-Chemical Industry"**

18410112c Moscow KOKS I KHIMIYA in Russian No 10, Oct 87 pp 56-57

[Article by O.F. Bukhareva, Moscow Chemical Engineering Institute]

[Abstract] This combined session of the above organization, the Coke-Chemical NTS sections of the USSR Ministry of Ferrous Metallurgy, and the Central Administration of the NTO of Ferrous Metallurgy met 18-19 March 1987, at the Scientific Research Institute of Coal Chemistry. The agenda was: 1) fulfillment of the scientific-technical program of 1986; 2) progress in construction and implementation of new coke production at the Bagleysk Plant; 3) improvements in quality of coke-chemical production; 4) development and introduction of additives in production of metallurgical coke; and 5) use of coke gas in blast furnaces. Under 1), a series of activities at various plants were recounted; the construction of the Bagleysk plant was far behind schedule, resulting in various problems. To improve the quality of casting coke, it is necessary to improve the quality of the crude base; the coking period should be increased to 24-30 hrs. The quality of ammonium sulfate could be improved by adding anti-caking agents and a granulation process. Due to budget restrictions, attention should be directed at purifying coke gas to obtain technical grade ammonia. After this meeting, two more problems were addressed: preparation of new engineering cadres because the schools do not prepare them adequately for their jobs, especially in the area of technology automation, and new approaches to loading coal into the baking chambers. The unanimously approved solution to the student cadres subject was to create scientific production study complexes and unified study plans which would be updated continuously. Another meeting of the Scientific Council addressed the construction of units for producing ferroalloy coke, using a circular furnace, and production of coke briquettes.

7813/9274

UDC 552.57:525.25

**Paramagnetic Characteristics of Sulfur-Containing Low-Metamorphized Donbas Coal**

18410112a Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 5, Sep-Oct 87 (manuscript received 25 Mar 87) pp 7-15

[Article by G.P. Temerova, L.S. Lyubchenko, V.K. Semenenko, V.I. Saranchuk, and A.F. Lukovnikov, Institute of Chemical Physics, USSR Academy of Sciences; Novocherkassk Polytechnic Institute; Institute of

Fossil Fuels; Institute of Physical Organic Chemistry, UkSSR Academy of Sciences]

[Abstract] In continuation of their studies, a more detailed examination of the paramagnetism of sulfur-containing coal was carried out, aimed at finding reasons for the differences in the behavior of self-igniting and non-igniting coals (SIC and NIC, respectively), in the case of ultrahigh frequency saturation. A correlation between paramagnetic characteristics of the coals (width, form, and position of the EPR spectra) and their tendency toward self-ignition was established. The EPR lines were narrower for SIC and broader for NIC; the SIC lines were shifted toward larger fields, NIC — toward smaller ones; SIC lines were more asymmetric than NIC lines. An increase in these changes in air, a shift in  $\log I$  as a function of  $\log P_{SIC}$ , and the fact that the initial segment of resonance line construction was related to Zeeman modulation were puzzling. Similar behavior was observed with synthetic polymers with highly conjugated bonds. Figures 6; references 15; Russian.

7813/9274

**Production of Liquid Distillate Products by Mechanical Chemical Treatment of Natural Bitumen and Flammable Shales**

18410112b Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 5, Sep-Oct 87 (manuscript received 2 Feb 87) pp 37-40

[Article by A.B. Val-Epshteyn, V.V. Platonov, T.M. Khrenkova, K. Valdes Martinez Juan, A.A. Chizhevskiy, and M.B. Shpilberg, Tula Pedagogic Institute; Institute of Fossil Fuels]

[Abstract] Mechanical processing of organic compounds makes them more reactive. In the present work, natural bitumen from Cuba and flammable shales (Baltic area and sulfur-containing specimens) were exposed to mechanical-chemical treatment in a vibration mill for 10-30 min. in air or in an inert atmosphere (20-40° C). The yield of the distillate from natural Cuban bitumen and from Baltic area shale was comparable; the sulfur-containing shale gave poorer results. Additional hydrogenation led to a much improved product, low in sulfur and nitrogen. This procedure yielded gasoline and diesel fractions suitable for production of motor fuels. References 4 Russian.

7813/9274



UDC 678.01:536.2:678.742.3-9

**Conductivity in Thin Polypropylene Films**

18410123a Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 296, No 6, Oct 87 (manuscript received 3 Feb 87) pp 1414-1416

[Article by V.M. Usichenko, A.P. Losoto, A.V. Vannikov, Yu.M. Budnitskiy, and M.S. Akutin]

[Abstract] Volt-ampere characteristics of thin polypropylene films were assessed to determine the conductivity of biaxially-oriented films under low pressures. The samples consisted of 1-6  $\mu\text{m}$  thick films fixed between two polished metal electrodes. Initially, at low pressures (0.2-0.5 MPa) the conductivity of the films increased with an increase in pressure, which was presumably due to improved contact between the measuring electrode and the film. At pressures exceeding 1.2 MPa, sufficient to insure good electrical contact, conductivity was not dependent on pressure. Furthermore, the data showed that, under pressures assuring a good ohmic contact, conductivity increased with a decrease in the thickness of the film. The volt-ampere characteristics were linear at low voltages, becoming non-ohmic at higher voltages. The nonlinear nature of the plots was attributed to the relatively greater concentration of charge carriers injected from the electrodes in strong electrical fields and to the presence of traps for the charge carriers. Furthermore, after several runs, areas with negative differential resistance appeared on the volt-ampere plots that presumably were due to such factors as double charge carrier injection from the electrodes or the appearance of regions with high current density. The presence of negative differential resistance in the polypropylene films suggest their potential use of generating oscillations. Figures 2; references 6: 5 Russian, 1 Western.

12172/9274

UDC 678.7:532.72

**Adsorption of Chlorinated Hydrocarbons by Polyethylene Terephthalate Fibers**

18410123b Minsk VESTI AKADEMII NAVUK BSSR SYERYYA KHIMICHNYKH NAVUK in Russian No 5, Sep-Oct 87 (manuscript received 10 Nov 85) pp 71-74

[Article by I.F. Osipenko, V.I. Martinovich, and Z.V. Shukelo, Institute of Physical Organic Chemistry, Belorussian SSR Academy of Sciences]

[Abstract] The physicochemical parameters of adsorption and desorption of chlorinated hydrocarbons on polyethylene terephthalate (PETP) fibers were determined in order to assess the feasibility of such treatment in improving the utility of PETP fibers in the textile industry. Adsorption studies conducted over a temperature range of 20-87° C with dichloromethane, dichloroethane, chloroform, and trichloroethylene showed that at 20° C, significant quantities (6-8%) of dichloromethane, dichloroethane, and chloroform were adsorbed. At temperatures approaching BP values, gravimetric analyses revealed that the adsorption rate equalled 12-13% for all the chlorinated hydrocarbons. Structural changes induced by stretching the fibers resulted in diminished uptake and enhanced diffusion coefficients, confirmed by determinations of activation energies. For example, in the case of chloroform, the activation energy for adsorption to unordered fibers was 36.0 kcal/mol, and to the oriented fibers, 15.4 kcal/mol. The  $T_{1/2}$  for adsorption were in the range of 60-600 s at room temperature, whereas desorption was a much slower process. Figures 2; references 8: 2 Russian, 6 Western.

12172/9274

UDC 539.196

**Selective Multiphoton Infra-Red Photodissociation of  $\text{CF}_3\text{DCI}$  Molecule by  $\text{CO}_2$  Laser Radiation**

18410018a Moscow *KHIMICHESKAYA FIZIKA* in Russian Vol 6, No 8, Aug 87 (manuscript received 15 Sep 86) pp 1056-1060

[Article by Sh.A. Mamedov, V.A. Petrishchev; Institute of Spectroscopy, USSR Academy of Sciences, Troitsk]

[Abstract] An experimental study of the parameters of isotope multiphoton dissociation of a  $\text{CF}_3\text{DCI}$  molecule is described, and the dissociation yield and selectivity as functions of experimental conditions are determined. It was found to be possible to decrease significantly (3- to 5-fold) the value of the energy density required for effective dissociation in the case of the  $\text{CF}_3\text{DCI}$  molecule in comparison with  $\text{CF}_3\text{D}$ ,  $\text{CF}_3\text{HD}$ , and  $\text{CF}_3\text{CCl}_3\text{D}$  because of the lesser value of the dissociation energy of  $\text{CF}_3\text{DCI}$  and because of the higher excitation rate which usually takes place for heavier molecules. High dissociation values and selectivity logarithms were achieved even with a comparatively high energy density ( $F = 6.5 \text{ J/cm}^2$ ). Use of a two-frequency method of dissociation usually permits reduction of the laser radiation required with a simultaneous increase in dissociation and the selectivity logarithm. Use of the two-frequency method of multiphoton dissociation in studying  $\text{CF}_3\text{DCI}$  made it possible to improve parameters of the process of hydrogen isotope separation. Spectroscopic characteristics and the results obtained for multiphoton dissociation of

$\text{CF}_3\text{DCI}$  showed it to be highly suitable as a working medium in the hydrogen isotope separation process. Figures 4; references 7: 4 Russian, 3 Western.

2791/9274

UDC 543.544.25:546.11.02.2.3

**Gas Chromatographic Analysis of Protium-Deuterium-Tritium Mixtures**

18410114 Moscow *VESTNIK MOSKOVSKOGO UNIVERSITETA: SERIYA 2, KHIMIYA* in Russian Vol 28, No 5, Sep-Oct 87 (manuscript received 24 Jun 86) pp 509-511

[Article by V.S. Parbuzin, A.A. Lukyanov, and E.S. Filatov, Department of Physical Chemistry, MGU]

[Abstract] A modification was developed for gas chromatographic analysis of six-component mixtures of hydrogen isotopes: protium, protium deuteride, deuterium, protium tritiate, deuterium tritiate, and tritium for low temperature selective adsorption analysis. The unique feature of this modification is the use of NaA zeolite as the most sensitive adsorber for work at liquid nitrogen temperatures, using hydrogen with a normal ortho-para composition as the carrier. Optimal conditions were determined to be: a stainless steel column packed with 0.12-0.25 mm NaA zeolite activated in dry helium at  $360^\circ$  for four hours. This method yielded symmetrical peaks, gave 10% shortened analytical runs, and improved reproducibility of the results. Figures 3; references 8: 2 Russian, 6 Western.

7813/9274

UDC 630\*86:061.22

**Tenth Plenary Session of Central Board of  
Scientific and Technical Organization of Paper  
and Pulp Industry**

18410019 Moscow GIDROLIZNAYA I  
LESOKHIMICHESKAYA PROMYSHLENNOST in  
Russian No 5, Jul-Aug 87 pp 30-31

[Article by G.A. Bogdanova]

[Abstract] The 10th plenary session of the Central Board of STO [Scientific and Technical Organization] of the Paper and Pulp Industry convened on 24 April 1987, in Moscow. An address by G.I. Sanayev, "Increasing the Role of Primary Organizations of STO of Scientific Research and Planning and Design Institutes in the Development and Introduction of the Achievement of Science and Technology into Production," emphasized that the Central Committee CPSU pays constant attention to problems of accelerating scientific and technical progress and of wide use of scientific achievements in the national economy. Science in the industrial sectors has an important role in solving these problems. The structure of the USSR Ministry of the Paper and Pulp Industry is described. Work of scientists and specialists at the 17 research institutes and branches showed some

shortcomings in 1981-1986. In the first three Five-Year Plans, the average economic impact from introduction of scientific and technical measures remained at low figures of 115-120 million rubles. One and one half years after compilation of the "Timber Industry Complex" comprehensive program for scientific and technical progress for 1991-2000, there are practically no new approaches or progressive ideas for creating the engineering and technology of the future. No sector has proposed any new, revolutionary process. In the 12th Five-Year Plan, a great deal of work must be aimed at creating technological processes and equipment and technical renovation of enterprises. The program for the renovation of production on the basis of modern engineering and technology for 1986-1990 and up to 2000 must be carried out. Many sectoral institutes are working on development of the wood chemical industry with good results in processing sulfite and sulfite lyes, creating new forms of products, and improving wood chemical industry products. Some achievements made in the 11th Five-Year Plan are listed. The plenary session adopted a resolution to work harder and more efficiently. Major trends of activity for achieving these goals were listed at the session.

2791/9274

UDC 539.18+541.124.26

**Energy Aspects of Mechanical Chemistry**

18410116 Novosibirsk IZVESTIYA SIBIRSKOGO  
OTDELENIYA AKADEMII NAUK SSSR: SERIYA  
KHIMICHESKIYE NAUKI in Russian No 5, Sep-Oct  
87 pp 48-59

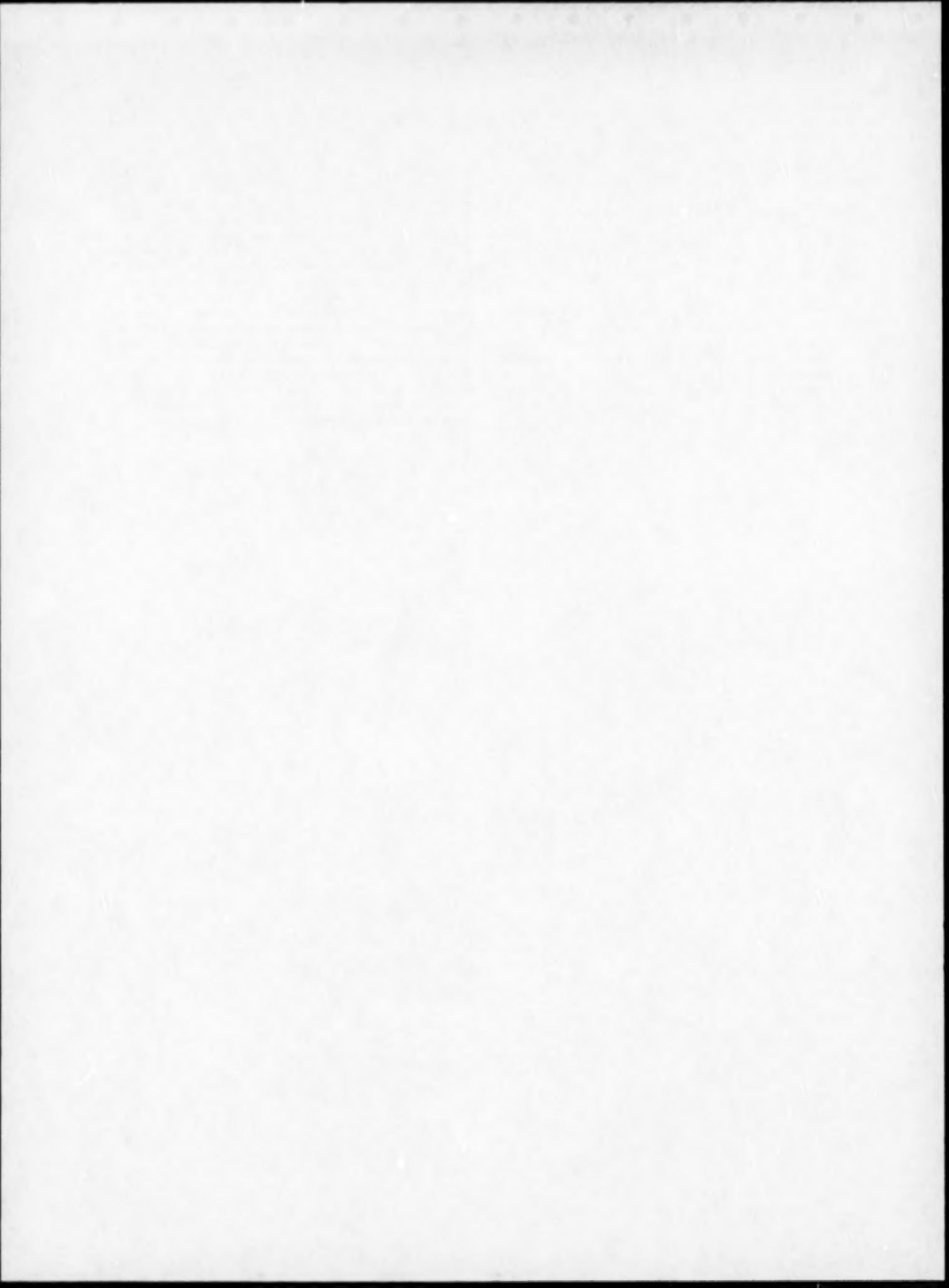
[Article by P.Yu. Butyagin, Institute of Chemical Physics,  
USSR Academy of Sciences, Moscow]

[Abstract] Breakdown and deformation are powerful  
actions on the atomic structure and reactivity of solids.  
Formation of new surfaces, dislocations, deformed, broken,  
or excited bonds are some examples of active states  
which initiate various chemical reactions. A review is  
presented in which an attempt is made to connect

mechanical chemical transformations with the mechanical energy levels accumulated by affected solids. The following subtopics were covered in this review: basic parameters of mechanical chemical processes; the energy yield in the formation of structural defects and mechanical chemical reactions; structural defect formation processes; and mechanical chemical solid-solid reactions in which molecular shifts occur not only due to mechanical but also chemical forces, while the product formation phase may be viewed as a relaxation process, terminating in crystallization of an unordered molecular solution. The energies of two types of such processes were compared: 1) formation of structural defects which initiate or accelerate chemical reactions and 2) mechanical mixing, which removes diffusion limitations from solid phase reactions. Figures 7; references 35: 21 Russian (2 by Western authors), 9 Western (2 by Russian authors).

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